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KANSAS STATE COLLEGE OF AGRICULTURE
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MANHATTAN, KANSAS

DEPARTMENT OF POULTRY HUSBANDRY

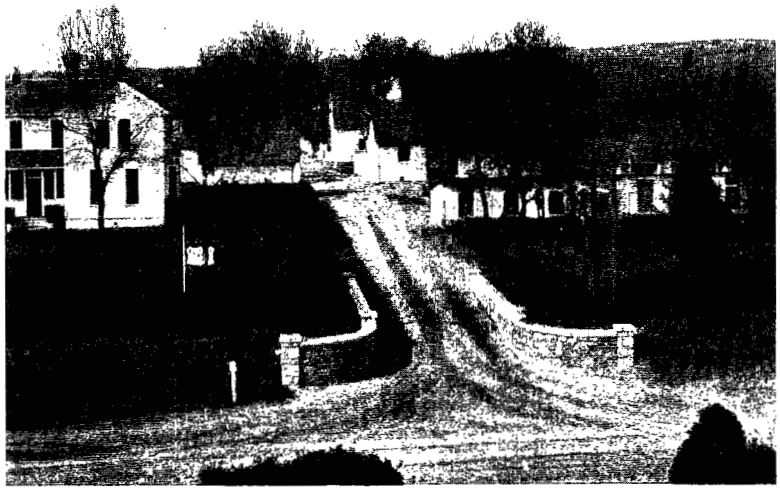

FIG. 1.—Entrance to the College Poultry Farm.

POULTRY MANAGEMENT[1]

LOYAL F. PAYNE

THE PURPOSE OF POULTRY RAISING[2]

There was a time when the selection of a breed called for first consideration in the establishment of a flock of chickens. In recent years this has been made subordinate to the size of flock and the purpose for which it is to be kept. If the object is to keep only enough chickens to supply the family table with poultry meat and eggs, the flock should be relatively small. Those who desire to make poultry keeping an important department on the farm and those who wish to operate on a commercial basis will require several hundred layers to meet their objectives. If one is primarily interested in chickens as a hobby or as pets, pleasure may be derived from keeping a few or many.

1. Contribution No. 90 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 75.

POULTRY AS A FAMILY ENTERPRISE

People who live in the suburbs or on farms and whose interest in poultry is primarily to supply eggs and table poultry for the family needs will find 30 good layers a sufficient number to keep for a family of five. Such a flock averaging 104 eggs per bird during the year, would provide 40 dozen eggs per capita for table use, 200 eggs for setting, and allow 17 percent adult mortality. From the 200 eggs could be hatched 100 chicks. These would provide 60 broilers for table use, 20 pullets to replace the 20 hens culled and

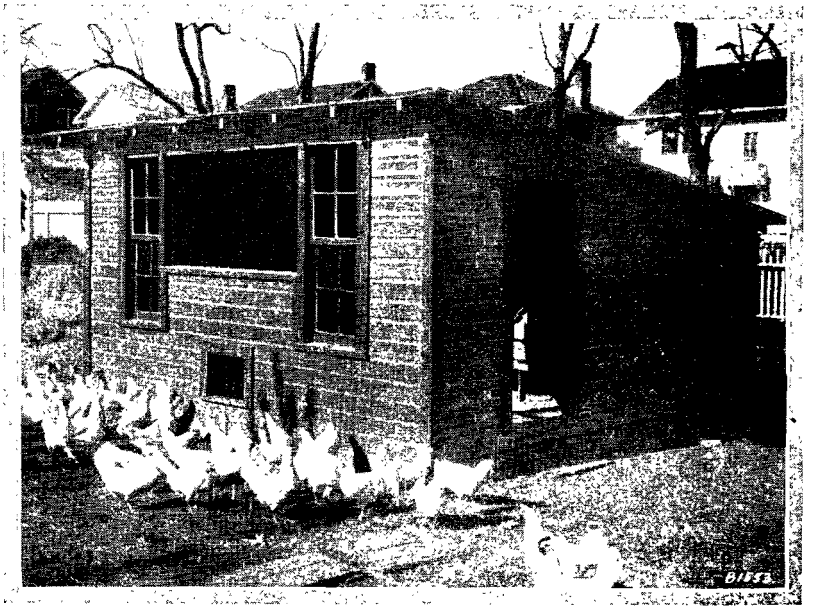

FIG. 2.—*A flock of 30 hens for family use.*

removed by death, and allow a 20 percent mortality. The 15 cull hens and 60 broilers would provide 15 chickens for each member of the family, which was the average number consumed on farms in Kansas a few years ago.

A flock of this size would not require much attention and it could live mainly on table scraps and the grain scattered about the farm buildings and lots. (Fig. 2.) Farmers who have no interest in poultry as a source of income, and those who specialize in the production of wheat or other crops in which most of the work comes at seeding and harvest time and who dislike daily routine work such as called for in most types of livestock production, might well consider a flock of 30 hens or six birds per capita in the family.

POULTRY AS AN IMPORTANT DEPARTMENT ON THE FARM

A book entitled, "Poultry Keeping as an Industry for Farmers and Cottagers," eighth edition, written by Sir Edward Brown of England, 1912, reports that "some time ago it was stated that the domestic hen had saved the state of Kansas, by which is meant that the farmers of the state named had been enabled to keep their heads above water by adding poultry keeping to their other operations." This fact was realized only too well during the years of depression since 1930. It has often been said that "chickens have been a life saver which has kept many farmers afloat." This has been true particularly for those who have kept flocks of approximatey 300 laying birds, the ideal farm unit for those interested in poultry. A flock of this size can be comfortably housed in a building 20 by 60 feet in dimensions. The addition of

FIG. 3.—This 20- by 70-foot house consists of three rooms, each 20 feet square, and a service room 10 by 20 feet on the left. This is a desirable 300-hen unit where poultry is an important department on the farm.

10 feet to the length will provide a feed and service room which makes a complete unit for the laying flock independent of other farm buildings. (Fig. 3.)

Assuming that such a flock consists of 100 hens and 200 pullets and that two thirds of the flock is to be renewed each year, it would require 600 chicks for this purpose. This number allows for 50 percent cockerels, 25 percent mortality, and 10 percent for culls at 24 weeks of age. A good system of management is to allow the hens free range throughout the year and to hatch from the general-purpose breeds such as Rhode Island Reds or Plymouth Rocks in March or from Leghorns in April. The pullets are usually placed in their permanent laying quarters early in September where they are confined until about May 1 after which they are given free range with the hens. While confined, the pullets are forced for maximum fall and winter egg production. Rigid culling is practiced

during the summer and by the last of August 100 of the best layers from both hens and pullets, as determined by well-known culling methods, are selected and returned to one unit in the house as the breeding flock for the succeeding year. There have developed recently two variations from this "standard" practice, both of which are adaptable to the buying of baby chicks rather than the practice of hatching eggs from the farm flock.

The first variation is to begin using artificial lights on the layers August 15 and feed for heavy egg production all fall and winter. The birds are confined after the first frost. In such cases the flock is usually culled to one half the original number. With this system one would buy 450 chicks to provide 150 pullets in the fall. With such an arrangement the 20 x 60 foot house should be divided with a solid partition in the middle giving two rooms 20 x 30 feet in size, each to accommodate 150 mature birds.

The second variation is to force the flock into an early molt June 1 by changing suddenly from the feeding of a balanced ration to a ration consisting only of whole grain and water. By the middle of August most of the birds are in new plumage and can be placed on full feed and given artificial lights as suggested above. The same arrangement of the house can also be used.

In both of these variations very good fall and winter egg production can be obtained, provided the flock is of a good laying strain and they are properly managed to avoid a second molt during the early winter. In both systems egg production declines below normal during the spring months in which case all old birds can be disposed of in April or May, the season of highest prices for fowl, if production should fall below maintenance costs. With these variations, only the pullet flock would be kept the remainder of the season and they in turn would be subjected to artificial light after August 15.

A flock of this size will convert, during the year, a large quantity of bulky grain into concentrated products, such as poultry meat and eggs. A fair estimate of grain consumed would be 1 bushel a year for each adult bird, 1/2-bushel for each chicken reared to 24 weeks of age, and 1/4-bushel for each chick kept until 12 weeks old. The flock of 300 hens and 600 chicks would consume, according to the above figures, 450 bushels of grain, and they in turn would produce for the farm many dollars worth of fertilizer.

It should be understood that grain alone does not constitute a balanced ration, but it does usually account for two thirds to three fourths of the feed intake. The supplementary feeds used with grain are meat and bone scraps, milk in some form, mill by-products, alfalfa-leaf meal, green feed, and minerals. (See page 34 for rations.)

It has been found that freight charges amount to about 33 percent more for grain than for eggs produced by the grain, and upon arrival at the terminal markets the eggs normally sell for twice as much as the grain is worth. Recent figures from the poultry department at the University of Missouri show that since 1917

there have been only three years in which the farmer failed to realize at least $2 worth of poultry products for each dollar spent for poultry feed. This indicates that the farmer who markets his grain in the form of poultry and eggs realizes about twice as much as he would by selling the grain direct. It pays to feed grain to hens in Kansas.

A flock of 300 birds represents a gross income of $800 to $1,000 a year and in a few cases it has reached $1,500 to $1,800 annually. This amount usually is sufficient to attract the interest and cooperation of the man of the family. With both the husband and wife interested, the usual result is that good equipment is provided, complete rations are fed, proper management is employed, and well-bred egg-producing stock is kept. It is usually a pleasure to care for poultry or to do any other work when one is properly equipped for the task. The satisfaction and pride taken in a flock of chickens, well housed, will go a long way toward guaranteeing success with this department on the farm.

Such a flock, while large enough to return a significant income, can be cared for on chore time and, therefore, does not interfere with the field work.

POULTRY AS A MAJOR COMMERCIAL ENTERPRISE

The number of commercial poultry farms in Kansas (500 or more adult birds in the flock) is, according to information obtained a few years ago, less than 4 percent of all the farms in the state. Those interested in devoting all of their time to poultry production might well consider a 1,500-bird plant managed somewhat according to the methods outlined for the 300-bird unit. (Fig. 4.) Three houses each 20 x 100 feet in size should be located to give adequate range for each flock, and at the same time minimize labor. One man can care for 1,500 layers without additional help, except possibly during the hatching and brooding season. Anyone contemplating the development or operation of a commercial poultry farm should communicate with the Department of Poultry Husbandry, Kansas State College, for more detailed information.

POULTRY AS A HOBBY

There are those in nearly every community who derive pleasure and satisfaction in breeding and exhibiting fancy poultry. The selection and mating of birds to attain certain well-defined standards in body type, feather color, and shape is fascinating, and for those who are proficient, it may become very remunerative. Since most people who are attracted to poultry as a hobby live in cities or villages, they find one or more of the scores of varieties of bantams well suited for this purpose. (Fig. 5.) The bantam presents all of the interesting breeding problems since there is opportunity to breed for such characteristics as body size and shape, plumage shape and color, width, length, and quality of feathers, comb size and shape, skin color, freedom from disqualifications, and vigor, the same as

FIG. 4.—A commercial poultry farm where the selection and breeding for increased number and size of eggs receive chief consideration. (Farm of J. O. Coombs & Son, Sedgwick, Kan.)

found in the large breeds and varieties. It requires just as much or more skill to reduce a bantam to the small size desired as it does to increase a bird of normal size to standard weight. Bantams occupy less room and make less noise than larger birds. In short, bantams are very desirable both as pets and hobbies, especially in towns and cities where space is limited and noise is a factor. Those not especially interested in bantams can keep one or more of the larger breeds of poultry.

FIG. 5.—A bantam fancier's poultry house (A) and pen of prize-winning Black Cochins (B). (Residence of W. F. Caskey, Topeka, Kan.)

THE SELECTION OF A BREED

For the small flock, one of the general-purpose breeds such as Rhode Island Reds, Plymouth Rocks, or Wyandottes are usually chosen. There is an opportunity for the selection of a wide range of color patterns in the above three breeds, any one of which would give fair egg production as well as supply the table with poultry meat of good quality. However, the Single Comb White Leghorn is popular even for the family flocks. It begins to lay when 5 to 6

months of age, is nonbroody, and will consume about 10 pounds of feed per bird less to maintain annually than the larger breeds.

In the farm flock enterprise of 300 birds, the Single Comb Rhode Island Reds and White Leghorns easily outnumber other breeds and varieties, although Plymouth Rocks, Wyandottes, and Orpingtons are occasionally kept. Hybrids, or first-generation cross pullets, are rapidly increasing in popularity and there is much to commend them for the production of market eggs where the proper crosses are made and the poultryman does not reproduce from his own flock.

Commercial flock owners in Kansas in most cases choose the Single Comb White Leghorn. This variety has been selected and bred for both large numbers and large size of eggs for many generations, and as a result it excels most other varieties in egg production.

The popularity of varieties in Kansas as determined from different sources is given in Table I.

TABLE I.—THE PERCENTAGE OF FLOCK OWNERS KEEPING VARIOUS POPULAR VARIETIES OF CHICKENS AS REPORTED BY DIFFERENT GROUPS

BREED AND VARIETY.	Survey of 250 representative Kansas farms.	Accredited and certified flocks (*a*).	1,000-member poultry club (*b*).	Average.
Leghorns, S. C. White	27	29	39	32
Reds, S. C. Rhode Island	27	20	17	21
Plymouth Rocks, White	5	16	11	11
Plymouth Rocks, Barred	14	8	7	10
Wyandottes, White	8	10	9	9
Orpingtons, Buff	12	5	5	7
Rhode Island Whites	4	4	3	4
Minorcas, White	0.8	2	2	2
Anconas	4	0.6	0.6	2
Miscellaneous		6	6	6

(*a*) Five-year average, 1930 to 1934. (*b*) Four-year average, 1931 to 1934.

The above three groups include more than 4,000 different flocks. The figures in the first column on the left, obtained in 1926 in a survey of 250 farms, were at that time representative of all sections of the state as they included all types of flocks regardless of size or quality. The accredited and certified group is more representative of flock owners interested in poultry improvement work and hence they represent the better flocks, the size of which may vary from a few dozen to more than a thousand birds. The figures in the third column from the left represent the most outstanding flocks in each county of the state and would include most of the commercial flocks, thus accounting for the large percentage of White Leghorns.

HOUSING THE POULTRY FLOCK

The principles involved in housing poultry differ somewhat from those employed for other types of livestock. It is important that the poultry house be provided with plenty of ventilation without drafts, with direct sunlight; that it be relatively free from excess moisture; and that extremes in temperature be avoided in both summer and winter. The laying hen is a "high-geared animal" and her needs differ from those of most other farm animals. For example, she has about 32 respirations a minute compared with 18 for man, her body temperature averages about 107° F., and it has been reported that her pulse reaches 350 per minute. The hen requires almost three times as much air to breathe per pound live weight as the cow. Since liquid urine is not passed and she has no sweat glands, most of the liquid is eliminated through the respiratory organs. Dampness in the litter resulting in high humidity within the house may cause more discomfort to the bird both in cold and in hot weather than would be true in a less humid atmosphere.

The principal difference between poultry houses and other livestock buildings is in the large open front provided in the former. About 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-weight 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 by 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. Beyond that length it is necessary to place solid partitions from front to rear to prevent end to end and whirling movements of air currents. Ventilation through the open front is not 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. 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 tightly 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 foundation should

be elevated 10 to 12 inches above the ground level 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 windbreak of trees, a hill, or larger building is an advantage 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

Permanent Laying House.— Permanent laying houses usually range in width from 16 to 20 feet. They may be as long as desired provided 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
10' x 14'	140	30	35
18' x 24'	432	100	120
20' x 40'	800	200	225
20' x 60'	1,200	300	340
20' x 100'	2,000	500	570

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.

FIG. 6.—A 20- by 70-foot glazed-tile house for 300 hens. (Farm of E. J. Mall, Clay Center, Kan.)

The value of increased depth in a house is the improved ventilation by leaving the front open most of the time throughout the winter. The roosts being far removed from the open front make the closing of curtains necessary only in very cold or windy weather. While a square house is the cheaper to build, a rectangular one makes less congested roosting quarters, permits sunshine to reach a larger area of the floor, and gives the house a better appearance. A house 20 by 70 feet with a gable roof and straw loft has proved very satisfactory for Kansas. (Fig. 6.) Glass windows are used in the ends and the rear, but not in front.

Brooder House.—A portable brooder house is usually built on 2- by 10-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 10 by 12 feet or 12 by 16 feet in size. (Fig. 7.) If moved when the ground is frozen or covered with

FIG. 7.—Brooder range at Kansas State College. Alfalfa and chicks occupy each of three ranges two years in six. The rotation of crops is alfalfa, corn, and wheat or oats.

snow, one team of heavy horses is sufficient, otherwise two teams or a tractor is required. A shed-roof type with glass windows in front and in the ends and with a small opening for ventilation between the front windows is commonly used. The opening is equipped with a muslin inclosed frame which permits an exchange of air without drafts. An opening 6 to 8 inches wide and extending across the upper part of the rear wall is provided for summer ventilation.

Permanent brooder houses have again come into use since the introduction of sanitary runways makes it possible to brood the chicks until 8 to 12 weeks of age without permitting them to come in contact with the ground. With this type of building, the early brooding operations can be carried on in an intensive manner near the residence with much less labor than is required when colony houses are located some distance away. The runways and summer shelters are required with a permanent brooder house.

SANITARY RUNWAYS

These runways consist of wire enclosures covering approximately the same area as the brooder room. The floors may consist of 5 to 6 inches of clean gravel or a frame construction covered with ½-inch hardware cloth. (Fig. 8B.) These runways are placed adjacent to the front of the brooder house. Their function is to give the chicks additional exercise and direct sunlight without coming in contact with the ground. The soil about most permanent

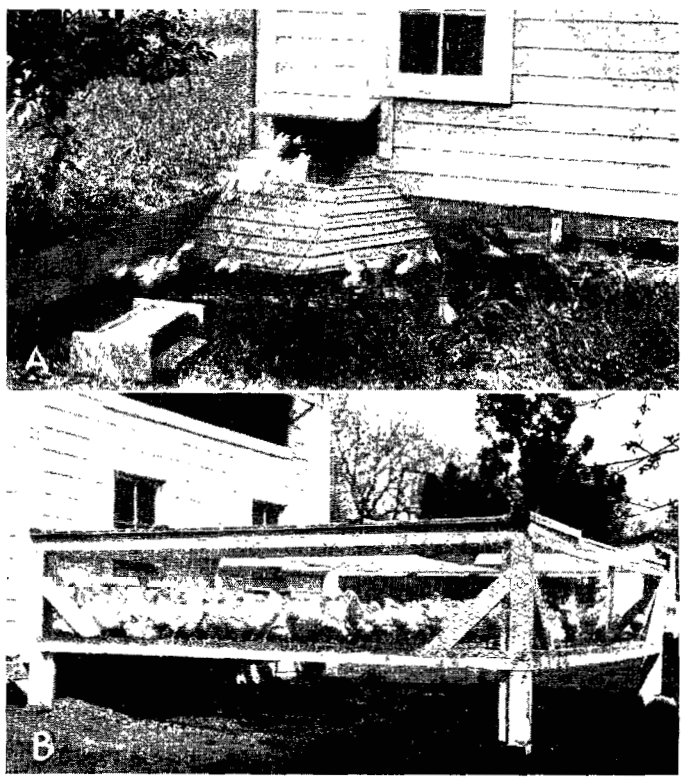

FIG. 8.—A wide opening into the brooder house and an approach that can be utilized from two sides (A) provide quick entrance and exit (B) Sanitary runway attached to the front of a portable brooder house and occupied by eight-week-old chicks.

brooder houses is heavily infested with the eggs of roundworms which cause heavy losses among young chicks. If the chicks can be reared to 12 weeks of age without becoming infested, the roundworms will not be so injurious as when infestation occurs at an earlier age. Clean gravel or coarse sand is an inexpensive type of floor in many sections of Kansas where this material is available, but it should be renewed each year. The original cost of hardware cloth is more than sand but it will last for several years and, being portable, can be moved about.

SUMMER SHELTERS

Chicks started in permanent buildings should be moved to growing ranges when 8 to 12 weeks of age. Adequate roosting quarters can be provided in the form of summer shelters. These are usually small, portable, wire inclosed shelters 10 feet square equipped with roosts throughout the interior so as to accommodate 125 birds. The gable roof may be covered with composition board, matched lumber, roofing paper, or shingles. One-inch poultry netting is usually stretched across the floor under the roosting poles to keep

FIG. 9.—(A) Rhode Island Red pullets on alfalfa range. The brooder houses and feed hoppers are located near the hedge which provides excellent shade. A flock of pullets inside the above hedge is shown in (B). (Farm of John Friederich, Clay Center, Kan.)

the birds out of the droppings and to protect them at night from predatory animals. Shade in some form should accompany the shelters. (Fig. 9.)

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 6 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 2-inch layer of concrete of a 1-3-5 mixture covered with a surface coat of 1 part cement to 1½ 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 1 inch of concrete. 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 because of rotting when wet, warping, splintering, and the harboring of rats underneath. Six-inch drop siding of fir, yellow pine, or car siding is advisable for the front, rear, and end walls. Tile blocks for walls are sometimes used when tile is cheaper than lumber. In such cases a good foundation is essential to prevent settling and cracking. It is important that the tile be well made and hard burned and that every joint be made air tight. Contrary to common opinion, a tile house appears to be colder in winter than one of wood construction. (Fig. 6.)

The roof may be covered with sheathing and roofing paper, corrugated iron, or shingles. Roofing paper is the least expensive but it is also short lived. In western Kansas it is frequently destroyed by wind, hence corrugated iron is being used more, especially in connection with straw-loft houses. An iron roof would be unsatisfactory without a straw loft or other adequate insulating material underneath. A shingle roof while a little more expensive is preferred to any other type. It is desirable to have a one third or greater pitch roof for shingles although they can be used with a one fourth pitch.

INTERIOR FIXTURES

In a well-planned poultry house, provision is made for a straw loft, 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 2 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 practice of placing the nests under the droppings boards has been discontinued by many poultrymen because of the tendency to produce dark corners on the floor. The interior fixtures are portable for convenience in cleaning and disinfecting.

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 at all times. (Fig. 10.) 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, mice,

and rats. In case of bad infestations 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. The straw is supported by one-inch-mesh wire, stapled under rather than over the ceiling joists. By closing the spaces between the studs and placing wire on the inside of the gable ends, rats and sparrow are excluded from the straw. So long as the straw does not become infested with parasites or vermin, it can remain for years without changing.

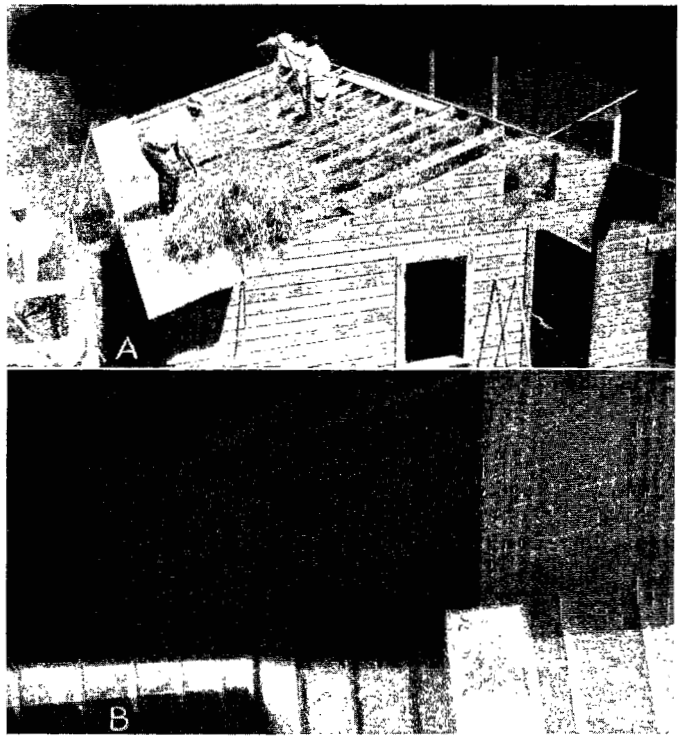

FIG. 10.—(A) Adding straw in a convenient way to the loft of a new poultry house. (B) The under surface of the straw loft. One-inch-mesh wire nailed to the lower edge of the joists supports the straw.

Roosts and Droppings Boards. —Roosts can be made of 2-by-2- or 2-by-3-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 9 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. There appears to be no advantage in having the roosts extend from front to rear of the house. The usual arrangement is lengthwise of the house. Two-inch poultry netting should be tightly stretched

under the roosting poles to prevent hens from scratching in the droppings and to protect eggs laid at night. Such eggs usually have soft shells which when accessible may start the flock to develop egg-eating habits.

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. It also aids in the production of clean eggs. The droppings are scraped from the boards once or twice

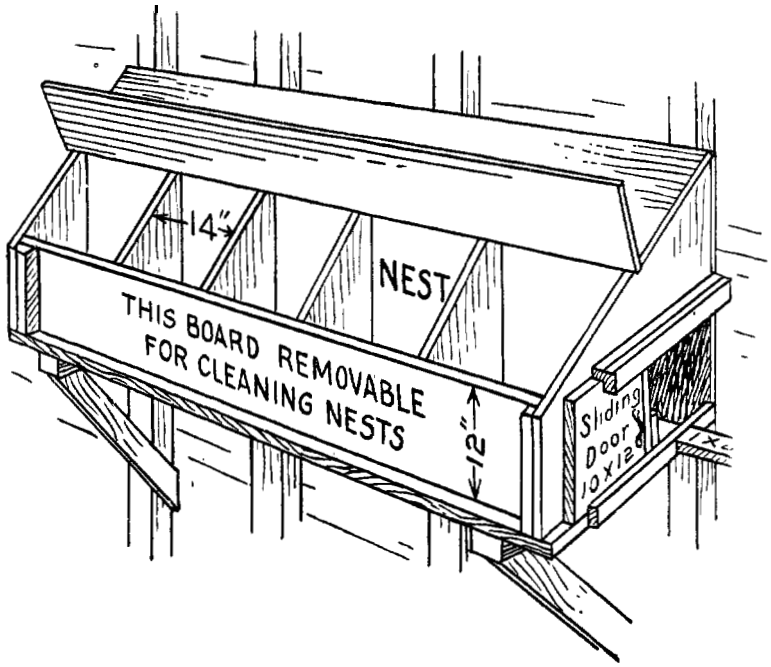

FIG. 11.—A battery of simple, convenient, and practical nests attached to the partition wall.

a week and scattered on fields not utilized as poultry range. Level droppings boards are considered better than the slanting ones in that they obstruct the light less and have less tendency to cause dark corners. They are placed about 30 inches above the floor.

Neither the roosts nor droppings boards should be higher from the floor than necessary to admit ample light underneath. When hens are required to jump too far from roosts, nests, or feed hoppers the mortality from ruptured ova appears to increase. This may also account for the high percentage of birds with bumble foot found in many flocks of Leghorns.

Nests. — The nests are conveniently located on the partition walls where the hens and eggs will be affected least by 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. (Fig. 11.) A nest 14 inches square and 12 inches high will accommodate the average hen. One nest is provided for every six to eight hens in the flock. If trap nests are used, one nest to four hens is desirable. A battery of nests resting on wall brackets is illustrated in figure 11. The batteries can be made two or three nests high if necessary. Well-cured hay, chaff, or straw makes good nesting material. Nesting material should be used freely to prevent soiled or cracked eggs. One half inch hardware cloth placed an inch or more from the bottom of the nest makes a good substitute for litter.

Antibroody Coop.—An antibroody coop is indispensable when breeds of the general purpose group are kept. The coop is made of 2-inch slats placed 1 inch apart on the bottom and 2 inches apart on sides and ends. It may be placed over or under the roosts, but a better location is outdoors in the shade and elevated 3 or 4 feet above the ground. Feed and water containers are attached to the outside. Birds should be confined in this coop upon the first indications of broodiness. The longer a hen remains on the nest the longer will be the time required to break her of her broodiness.

Dry-mash Hopper.—A nonwaste, nonclog mash hopper is one for which poultrymen have striven many years. The hopper illustrated in figure 12 approaches these requirements very closely.

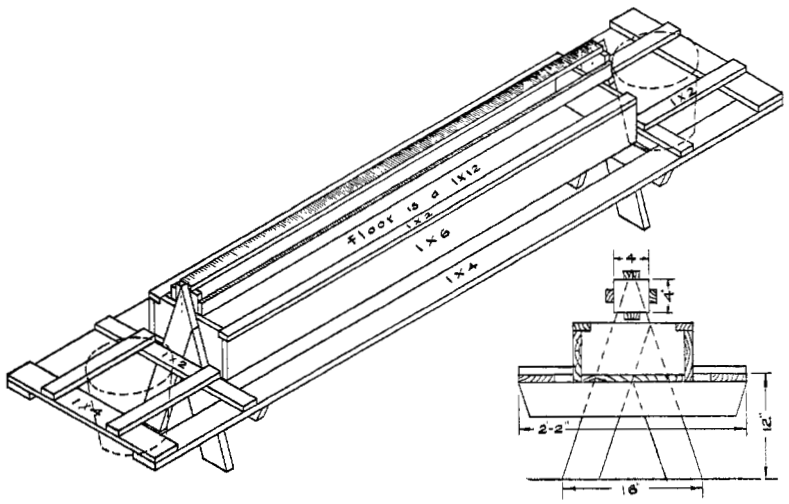

FIG. 12.—Views of an indoor nonclog, nonwaste, dry-mash hopper.

Bll of Material

One 1″x12″x6′ for floor of feeder
Two 1″x6″x7′ for sides and ends.
Two 1″x4″x6′ for legs and cross pieces
Two 1″x4″x12′ for rails and end ties
Eight 1″x2″x6′ for reel, edge of box, and bucket guides
1 pound 6d box nails

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. One hopper of this size is sufficient for 100 hens, except where all-mash or mash and grain are hopper fed, in which case two such hoppers should be provided for 100 birds.

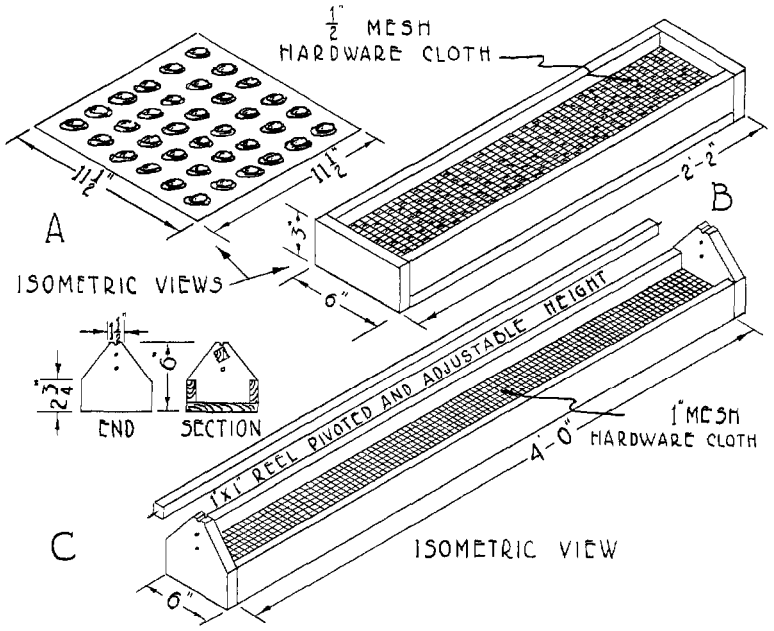

FIG. 13.—Feeders for chicks of different ages. (A) Egg-case cup flats used the first five to seven days for training chicks to eat. (B) A rectangular feeder with wire cover used for chicks one to four weeks old, and (C) a larger inside feeder suitable for chicks up to 20 to 24 weeks of age. By using a screw in one end, the reel can be adjusted to three different levels.

Young chicks require feeders of different sizes as they increase in age. The common cupped egg-case flats make satisfactory feed containers the first few days. The cups retain the feed and being easily accessible and nonslippery, make safer footing for the chicks and less waste than smooth paper or composition boards. (Fig. 13A.) After the chicks have learned to eat, a rectangular shaped feeder is substituted for the cup flats. A piece of ½-inch hardware cloth cut to fit loosely inside the feeder and to settle as the feed is consumed will prevent scratching and thus reduce the amount of feed wasted. (Fig. 13B.) A still larger hopper (fig. 13C.) is required after the chicks are 4 weeks old. One-inch-mesh wire in addition to a rotating reel will further reduce the waste of feed.

When the chicks are moved to the range at eight to twelve weeks of age, additional outdoor feed hoppers are required. These should be large enough to hold 10 to 20 bushels of feed and the roof should extend over the feeding platform far enough to shade the chickens while eating and to prevent rain moistening the feed. (Fig. 14.)

Curtains for Open Fronts. — Open fronts, which are covered with either 1/2-inch hardware cloth or 1-inch-mesh wire netting, are equipped with curtains which are closed in cold or windy weather. The curtain material is either medium-weight muslin or a single

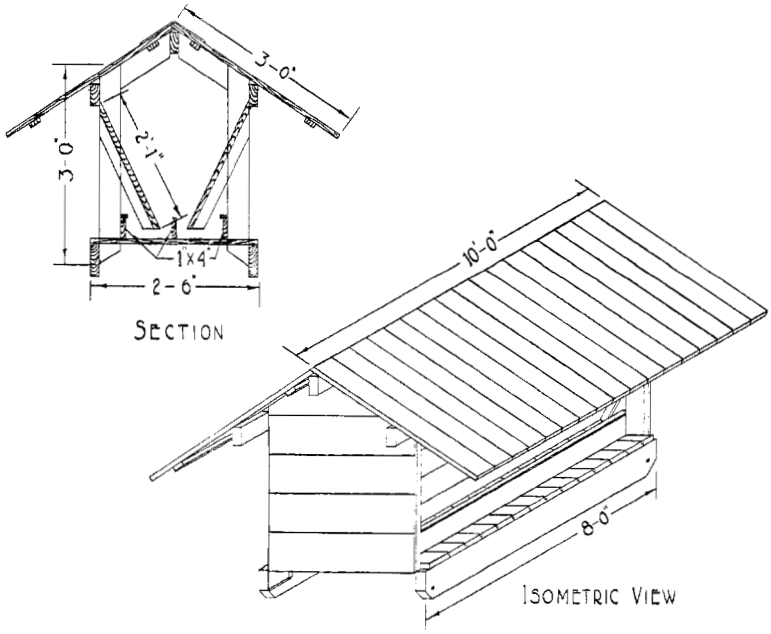

FIG. 14.—Two views of a large outdoor range feeder. Capacity, 20 bushels.

thickness of burlap. The object of using coarsely woven material is to permit the circulation of air through the cloth. While heavy cloth such as ten-ounce duck is not satisfactory, light-weight duck can be used in localities where muslin is frequently torn by strong winds.

The curtains are tacked to well-constructed frames made of 1- by 2-inch material and installed to slide up and down with window catches on the sides to regulate the amount of open space according to the weather. When not in use, they are dropped down inside of the front wall.

Electric Wiring. — Where electricity is available, the poultry house can be wired to provide current for artificial illumination or for heating drinking water during the winter. Two or three wires, size number 14 for 15 amperes, enclosed in a single cable are safest

when installed inside of a rigid metal conduit. Two Edison base sockets and one convenience receptacle should be installed in each room. In a room 20 feet square the light sockets should be midway from front to rear and 5 feet from each end wall. The object of a third wire in the cable is to make it possible to operate the lights on one pair of wires and the water heater on another pair. In this way the lights can be turned on and off without influencing the heater. An electric bulb suspended in a metal cylinder filled with sand will, when placed in a bucket of water, prevent freezing in extremely cold weather. The cylinder should be about 3 inches in diameter by 12 inches high. Such equipment is inexpensive and does not "burn out" when the water becomes low in the bucket. An ordinary alarm clock with a large stem which unwinds when the alarm goes off can be easily equipped to either turn the lights and heat on or off at any hour of the day or night. There are also time clocks for this purpose, but they are usually expensive.

Miscellaneous Equipment.—A bin for storing grain is most convenient when attached to an end wall with the bottom 14 to 16 inches above the floor and a sliding shutter at the bottom to facilitate emptying the bin for weighing back feed or changing grain. The cover to such a bin should have a steep slope as illustrated for the nest (fig. 11), to prevent birds roosting on it. A wall rack made of lath 2 or 3 inches apart and sloping in at the base with a box-like container at the bottom is often used for feeding green alfalfa or other legume hay to the flock. Oyster shell, grit, and charcoal can be fed separately by nailing 1- by 4-inch boards across the studs next to the foundation. V-shaped wooden troughs with a guard or reel across the top to keep the birds from standing in them can be used for feeding wet mash, liquid, or condensed milk.

SUNSHINE

The value of sunshine in destroying disease germs, drying, illuminating, and warning 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. Thin-shelled eggs and low hatchability may result from a lack of sufficient sunshine during the spring months. Tests by the Department of Physics at Kansas State College showed that 10 percent of the ultra-violet rays (which are the beneficial rays) would penetrate glass cloth, 25 percent would pass through cel-o-glass, and 33 percent would pass through medium-weight muslin. Hens with access to direct sunshine only a few minutes each day need very little if any fish oil in their ration. Weather bureau figures show that Kansas has almost 70 percent of sunshine available during the year.

Sunshine which passes through glass has relatively little 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 high-speed machines they are short lived. One half to two thirds 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 percentage 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; rate of growth; body size; shape; the number,

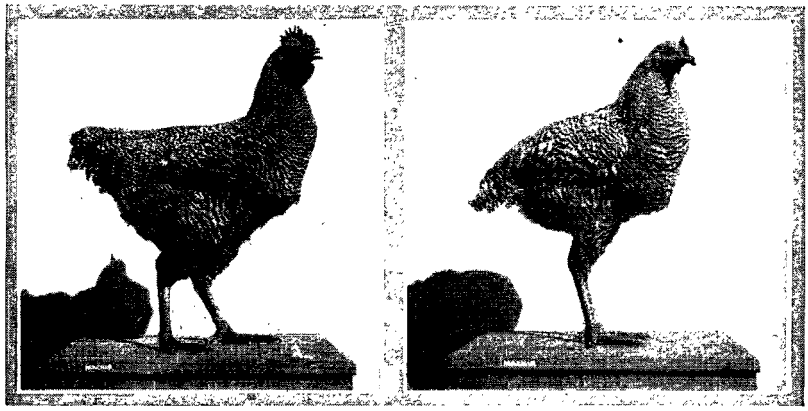

FIG. 15.—Good vigor is shown by the cockerel on the left and low vigor by the one on the right. Note the difference in the size of head, shape of body, and carriage of the tail.

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 his flock may be, if it lacks vigor it will not long survive.

The contrast in appearance between good and poor vigor is well illustrated in figure 15. The vigorous bird has a short, well-curved beak, prominent clear eyes, a relatively deep, broad head with a bright red color in comb and wattles. The back is broad and carried level to the tail. A full breast and well-developed abdomen give the body a rectangular appearance. The legs are squarely placed, free from bowing or knock-knees, and stand wide apart. This description applies to both males and females. In addition, vitality in a female may be further recognized by her friendly attitude, good appetite, and well-developed comb, wattles, and earlobes when in condition to lay. The male displays a masculine appearance in head,

comb, wattles, and earlobes, and shows spirited aggressiveness and a gallantry which is evident by his attentiveness toward the females. 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.

Selecting Breeding Stock. — The cockerel that crows first and the pullet that lays the first eggs 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 small-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 12 months of age, are also undesirable. The most desirable age to have pullets come into production is 6 to 7 months for Leghorns and 7 to 8 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. Not that the eggs hatch better, but they usually produce larger chicks, which are inclined to be more vigorous than chicks from pullet eggs. The use of hens as breeders probably reduces adult mortality since they must have survived the first year of egg production. Work at the Massachusetts Agricultural Experiment Station involving more than 9,000 Rhode Island Red breeders indicated that the only types of matings which significantly reduced adult mortality were those in which three-year-old males were mated with two- and three-year-old hens.

Hens may be used for the production of hatching eggs until they are two to five years of age. When it is necessary to hatch from pullets, they should be well-matured birds, preferably with an induced pause in production just prior to the breeding season.

Mating to Increase Egg Production. — The art of culling has made it possible to recognize 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 result.

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. The flock should be mated five to seven days before the eggs are saved for incubation. If it becomes

desirable to change males, three weeks should elapse after the exchange before saving eggs if one wishes to be certain that the offspring are from the new male. There seems to be no advantage in keeping the males isolated from the flocks during the winter prior to the breeding season, unless *a* premium price is being received for infertile eggs.

Selection and Care of Eggs for Hatching.— From a well-selected flock 75 to 80 percent of the eggs gathered will qualify as desirable for hatching purposes. Eggs weighing 24 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 not be incubated.

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 poultry breeders or 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 of good quality 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 avoided when one buys the year's supply of chicks from good stock, properly hatched early in the season, and broods 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 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 should be placed in a quiet 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 15- by 30-inch coop with an 18-inch front and a 12-inch back wall is the ideal size. It should have a removable partition in the center and a shed roof hinged at the top and hooked to the rear. A wire-covered runway in front is provided for feed and exercise. Such a coop is illustrated in figure 16. The coop is

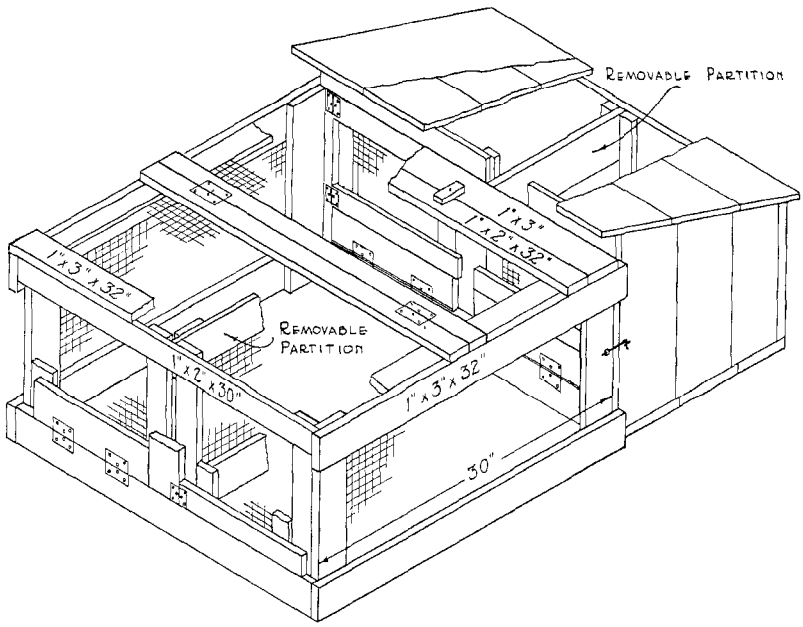

FIG. 16.—A portable, inexpensive coop for hen hatching and breeding. Capacity, two hens.

light, portable, serviceable, and attractive. Cheap boxes or barrels may be used, but they are not so accessible, nor do they afford the protection to the hens or the chicks as does this coop which is a combination for both natural incubation and brooding facilities.

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 in the earth nest and it is ready for use.

Choosing the Hens. —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 destroy all lice. (Never dust the hens just before the hatch, as the powder will irritate the eyes and air passages of the chicks.) After this the hens may be entrusted with the eggs they are to incubate. It is customary to set 11 to 15 eggs under each hen, 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. It is advisable to clean the dirty eggs by scraping and rubbing with a damp cloth when not too badly soiled.

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. According to United States Department of Agriculture figures for 1929, hens or natural incubation was used to hatch 42.8 percent of all chicks reared in the United States that year. Commercial incubators were employed to hatch 33 percent and small farm incubators accounted for 24.2 percent.

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 that may be contracted by association with hens.

Selecting an Incubator. — There are three distinct types of incubators which are commonly referred to as hot air, hot water, and forced draft or agitated air 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 into the air chamber, past a metal cylinder heated by the lamp. It circulates in the chamber 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. Because of 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. In the forced draft type the source of heat may be hot water, steam, or electric coils over which air is forced by means of electrically driven fans or reels. The air in the incubators is changed much more frequently with this type than with either of the others mentioned above. The temperature is uniform around each egg and humidity is adequately provided for by the introduction of live steam or fine mist into the egg chamber. The forced draft principle of distributing heat is confined to mammoth

incubators. Good results are secured from all three types of incubators when they are provided with good eggs and are properly operated.

The important factor 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. The machine should have the insurance underwriters' indorsement in order that the insurance policy on the building may not become void in case of fire.

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. To provide ventilation in the room without causing 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 cause variation in 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 Small 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 semiround flame. The best grade of kerosene should be used in the lamp bowl. In filling the lamp bowl, leave ½ inch at the top for expansion of the heated kerosene, thus preventing overflow. Light the lamp, put it in place, and turn the flame up just enough to be seen above the cap. Allow it to heat five or six hours after which time turn the flame up until ¼ inch appears above the cap, in which position it should remain while regulating the incubator to the proper temperature.

Follow carefully the instructions provided 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 damper over the lamp chimney, and third the lamp flame. If something is wrong decide which part is at fault and correct it before opening the door to 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 may 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 provided the operation has been correct.

A dark cloth may be hung over the glass door to keep the chicks quiet while hatching and to prevent crowding near the front.

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 ½ inch to 1 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 thermometer 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 average conditions one can expect from every 100 eggs set, 10 to 15 infertile, 20 to 30 dead chicks in shell, and from 55 to 70 strong, healthy chicks. Many operators secure better and a few poorer results than this. Much will depend upon the breed, the management, and the skill of the operator.

SEXING BABY CHICKS

The three methods of determining sex in day-old chicks are (1) to mate early feathering males on late feathering females, (2) to cross certain varieties which differ in feather pattern, and (3) to make an examination of the vent.

Rate of feathering is sex-linked and is expressed as crisscross inheritance. That is, the character observed appears in the opposite sex from the parent used in the mating. Most Leghorns are early feathering and most of the general-purpose breeds are late feathering. When an early feathering Leghorn male is mated with

a late feathering female, the daughters will all be early feathering and show advanced growth of the primary wing feathers as day-old chicks whereas the sons will show little if any wing feather development. This method can also be used to determine sex in standard-bred chicks where early and late feathering individuals have been identified and marked at 10 to 12 days of age and mated in the above manner when mature.

The second method involving color patterns of chick down as found in certain crosses is fully discussed in Bulletin 252 of the Kansas Agricultural Experiment Station.

The third method which consists in the examination of a rudimentary organ in the vent known as the phallic knob was developed by certain Japanese investigators. There is widespread interest in this practice at present and many people in America have taken special training in order to become skilled sexers.

Space does not permit a full discussion of the technique used other than to say that chicks should be examined between 12 and 24 hours of age. There are six different types of knobs, three of which are present in both males and females. This fact interferes somewhat with the achievement of 100 percent accuracy. Observers to attain skill should have a strong light, good eyesight, and nimble fingers. After practicing on thousands of chicks, one should be able to handle 200 to 300 an hour with an accuracy of 85 to 90 percent.

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 their health impaired in any way, the result may be slow-developing broilers, undersized pullets, retarded egg production, and poor hatchability in the eggs produced.

NATURAL BROODING

The coop shown in figure 16, 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 mother 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 out of hearing of her warning call in case of danger.

This method is satisfactory where comparatively few chicks are hatched each year and especially for the rearing of pheasant, quail, or other game birds. 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

For artificial brooding the type of brooder selected will depend upon the number of chicks to be brooded. Brooders may be conveniently classified according to capacity into small, medium, and large sizes. 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.

Small Brooders. — Small numbers of chicks may be kept comfortable in fireless brooders or under one of the various types of blue-flame oil, gas, or electric brooders. Fireless brooders are made by surrounding large jugs with burlap or felt. The jug is 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 4 or 5 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 for small numbers of chicks and when it is impractical to use other methods. There are on the market small brooders heated by kerosene, gas, or electricity which can be used for 200 chicks or less. For winter or early spring brooding it is usually advisable to provide supplementary heat in the building where these brooders are operated.

Medium to Large Brooders. — For the brooding of 200 to 1,000 chicks in one unit, an air blast oil, coal, or gas-burning, or an electrically heated brooder should be used. These are usually available in three different sizes, thus being adaptable for numbers ranging up to 1,000 chicks. Only commercial poultrymen who can give their undivided attention to brooding should attempt to keep more than 250 in one unit. Better results are usually obtained by farmers who keep only 250 chicks under each brooder.

The air-blast oil brooders have rapidly increased in popularity, largely because distillate oil is an economical, convenient, and dependable source of heat. (Fig. 17A.) The fuel consumed is in direct proportion to the atmospheric temperature. In cold weather it provides adequate heat to keep the chicks comfortable and in warm weather fuel consumption is reduced to a minimum by thermostatic control of the oil supply, yet without danger of extinguishing the fire. In other words, the flame is reduced to a mere "pilot light" during the heat of the day when the chicks do not require heat from the brooder, while with the onset of the lowering temperatures during the early evening and through the night the temperature of the brooder increases as needed. The oil reservoir is located outside of the building and a drain pipe should be provided to convey the overflow to a safe distance from the stove in case the oil should

feed faster than it is consumed by the flame. These two features reduce the fire hazard. The fumes from the stove are quickly conveyed outside and thus the air in the brooder house remains fresh and wholesome.

Coal store brooders, once very popular, are rapidly being replaced by other types. The difficulty of obtaining a satisfactory fuel and of maintaining a sufficiently low fire during the heat of the day in the late spring have contributed to its loss of popularity.

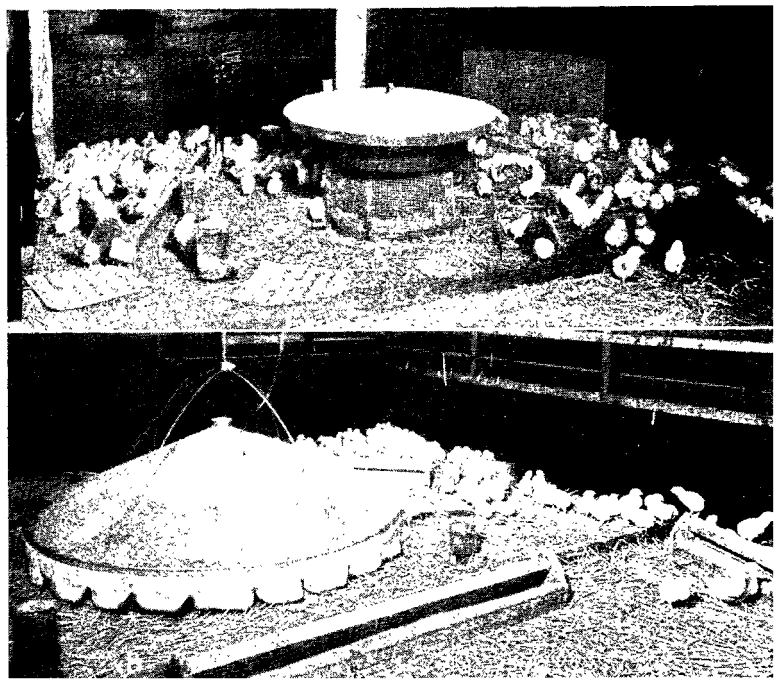

FIG. 17.—One type of air-blast, distillate-oil-burning brooder (A) and an electric brooder (B). Each will comfortably accommodate 300 to 400 chicks.

Hard chestnut coal is the most satisfactory fuel, but the cost in Kansas makes it almost prohibitive.

Brickettes, nut or petroleum coke, and Bernice anthracite number 4, are the most satisfactory sources of fuel for coal-burning brooders. The brickettes made with standard or Bernice semislack and oil are recommended. Those made of soft coal and oil do not give best results.

Gas and electricity are excellent sources of heat where available at a reasonable cost. Gas burners and thermostats can be installed in coal-burning brooders or especially built gas brooders may be purchased.

Electric brooders have been materially improved in recent years so the operating cost, with electricity at 3 cents or less per kilowatt hour, compares favorably with coal and distillate oil. (Fig. 17B.) The most recent forced draft electric brooder is said to be even more economical to operate than other types.

Homemade Brooders. — The homemade underground heated and brick brooders have come into limited use during the depression. Their economy of construction and operation have been their chief assets. Wood is used as a fuel and a more uniform temperature can be maintained when wood seasoned for different periods is available for holding fire. It takes about two cords of wood a

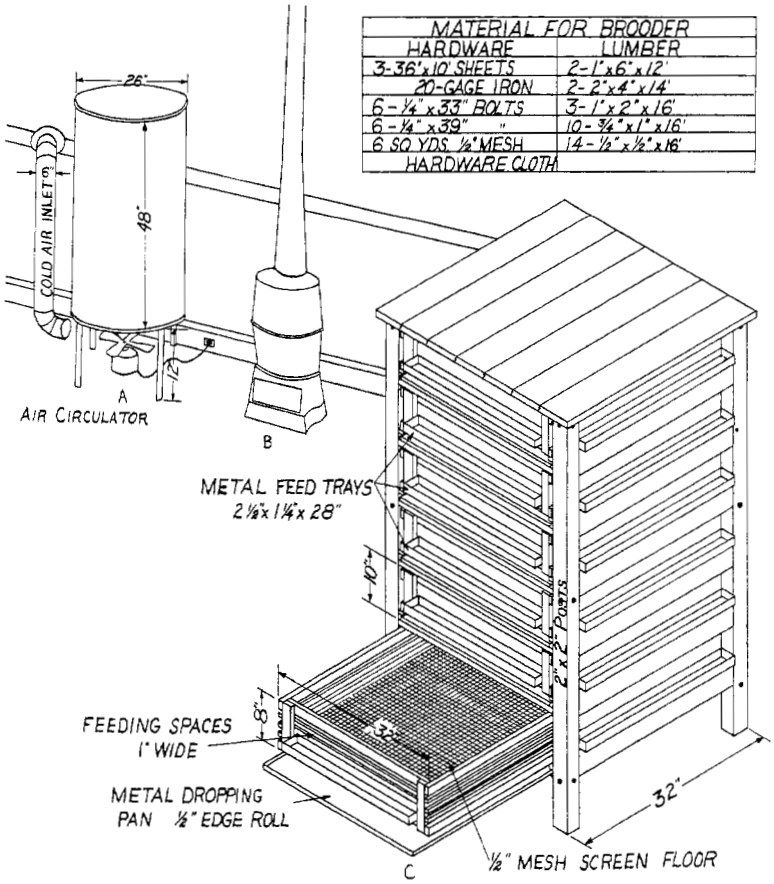

FIG. 18.—A home-made battery brooder for starting chicks. The air circulating tube (A) with electric fan provides an even temperature at all levels in the room. Heat is supplied by a brooder stove (B). The battery brooder (C) has six removable trays. The capacity is 600 chicks one to three weeks of age. The heating units (A) and (B) are sufficient for four to six batteries in one room.

season for a brick brooder. Green hard wood 6 to 8 inches in diameter and 2 feet long is the most satisfactory. While the supplying of heat to chicks from below is contrary to nature and wrong in principle, it is being used by a few people who understand artificial brooding and who are willing to give the close attention required. The brick brooders which are constructed inside of the house are more practical than underground brooders. It should be understood that these types are to be recommended only for those who cannot afford an oil or gas burning brooder, which is much more satisfactory over a period of years.

Battery Brooders. — There are two types of battery brooders. (1) One type has the heating elements installed in each compartment. The source of heat may be electricity or a kerosene lamp sending heat through a zigzag conduit from bottom to the top of brooder. This type requires supplementary heat in the room early in the season. (2) The whole room in which the batteries are located is heated to the desired temperature by a stove. An air circulating tube with electric fan to drive the air from floor to ceiling produces a fairly even temperature at all levels in the room. (Fig. 18.) This is very essential for successful results. It will be noted that electricity is required for both types, the one exception being the zigzag kerosene heated battery. Where chicks of different ages are to be brooded in the same brooders, it is desirable to have two rooms for brooding, one for starting the chicks the first week and the other for developing the chicks between two and four weeks of age. The temperature in the starting room should be 90-92° F. and in the growing room 80-85° F. A relative humidity of 60 to 65 percent in both rooms is satisfactory.

The chick compartments are approximately 32 inches square and arranged one above the other to a height of four, five, or six tiers and about as many feet. Movable trays with 1/2-inch hardware cloth floors are used and on all four sides are provided 1-inch openings through which the chicks feed. The feed and water vessels are placed outside of the trays and movable pans are placed under the trays to collect the droppings. Sand, sawdust, lime, or old newspapers are placed on the trays to simplify cleaning. The droppings should be removed once or twice daily.

The number of chicks to place in a compartment is determined by the area. A good ratio of chicks to floor area is as follows:

Age of chicks in weeks	Number of square inches per chick
1- 3	10
4- 6	20
7-10	40

Another way to adapt the capacity to the growing chicks is to reduce the number one half every three to four weeks depending upon the breed and size. For example, if 112 chicks were placed in a compartment to start with, the number should be reduced to 56 at four weeks of age, and 28 when eight weeks old.

There are several different makes of battery brooders on the market all of which are of metal construction. Home-made batteries constructed of wood and wire have given fairly good results. (Fig. 18.) The important points to keep in mind are to provide sanitary conditions and to maintain uniform temperature at all levels. Battery brooders make it possible to start large numbers of chicks in small areas, thus the work is concentrated and inclement weather is no factor. This method is used chiefly for the production of broilers and for carrying other chicks to the age of three to four weeks, after which they should be brooded on the floor in the usual way.

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 are sufficient time to get the brooder regulated to the proper temperature which is 95 to 100 degrees F. 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 sanitary runway should be provided for use after the first week, and chicks should be permitted to run out in the sunlight as much as possible. They 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 for four or five times, the chicks will go out and in of their own accord.

In the operation of battery brooders it is important that light be excluded from the interior of the batteries. Only a small amount of light is required in the room to enable the chicks to see to eat and drink. The light should be available on all four sides of each battery. Fifteen-watt bulbs are adequate even with all natural light excluded. Semidarkness in the batteries is essential to prevent the habit of cannibalism developing.

POULTRY NUTRITION

FEED REQUIREMENTS

Poultry nutrition embodies the feeding of grains, animal by-products, vitamins, and minerals. In addition to these the ration must be palatable if best results are to be obtained. A brief discussion of each follows.

Grains. — The grains required for poultry feeding can be grown on the farms of Kansas. It is not necessary to buy a large variety of expensive feed for good results. The grains recommended are yellow corn,[3] kafir, wheat, milo, barley, or oats. These may be fed alone or in combinations of two or more mixed together. There is no section in Kansas in which some of these grains cannot be grown. This first group of grains contains those feeds which supply most of the body heat and energy, that is, carbohydrates. They do not supply all the necessary nutritive elements when fed alone or in combination, hence, must be supplemented with other feeds to make up for their deficiency.

Animal Products. — A second group of feeds, including insects, milk, fresh meat, commercial meat and bone scrap or high-grade tankage, contains other essential nutrients. This group is rich in protein which is necessary to supply muscle and feathers in growing chicks and the egg in laying 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 or supply fresh meat, such as rabbits, or purchase some of the commercial forms of protein feeds. The source of animal protein also furnishes some of the important minerals.

Vitamins. — A third group of foods supplies vitamins which are essential for growth and reproduction. They have been termed accessory or protective food substances and while present only in minute quantities in many of the common feeds, they are indispensable for normal nutrition.

Only recently has it been possible to assign potency values to the different feeds containing vitamins. Methods are now available, however, by which it is possible to assign definite unit values to some of the vitamin-containing feeds. The six well-known vitamins are A, B, C, D, E, and G. All of these are essential in the poultry diet except vitamin C. The source and function of these five essential vitamins and the effects of a deficiency of these vitamins in the poultry ration are given in the accompanying tabulation.

Minerals. — The fourth group of feeds consists of minerals which are supplied by feeding bone meal, oyster shell or limestone, grit, charcoal, salt, and water. Bone meal is required for the development of bone and muscle and oyster shell for the production of

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

THE SOURCE AND FUNCTION OF VITAMINS A, B, D, E, and G, AND THE EFFECTS OF THEIR DEFICIENCY IN A POULTRY RATION

VITAMIN.	Source	Function.	Results of deficiency.
A.....	Leaves and blades of green plants, yellow corn, green alfalfa hay, yellow tubers, fish-liver oils, whole milk, and egg yolks.	Growth-promoting. Stimulates appetite and digestion. Essential for reproduction. Protects against certain diseases.	Sore eyes. Lowers resistance to infections in regions of the head, alimentary canal, and kidneys. Retards growth. Lowers egg production and hatchability.
B or (B_1).....	Wheat germ and outer covering of grains, dried brewers' yeast.	Prevents nervous disorders, essential for reproduction, promotes appetite and digestion.	Nervous disorders (beriberi) in man. Lack of coördination of muscles. Digestive disorders. Loss of weight.
C.....	Citrus fruits, spinach, cabbage, lettuce, tomatoes.	Not essential in the poultry diet	Scurvy in man.
D.....	Direct sunlight, fish-liver oils, ultra-violet light, eggs, and certain irradiated feeds.	Regulates utilization of bone-forming elements, calcium and phosphorus.	Rickets or soft bones, thin-shelled eggs, low hatchability, muscle and nervous disorders. Low calcium and phosphorus in blood.
E.....	Wheat germ, liver, and leaves.	Essential for reproduction in both sexes. Anti-sterility	Sterility—degeneration of certain reproduction functions
G or (B_2).....	Milk, alfalfa leaves, yeast, liver, spleen, and kidneys.	Promotes growth. Is heat-resisting. Increases hatchability. Antipellagrous.	Pellagra—thickening of the skin—sore tongue and mouth—nervous disorders.

egg shells. Neither of these will take the place of hard grit which is needed for grinding the feed. Charcoal is sometimes used for the favorable effect it has in the digestive tract. One half to 1 percent of salt in the ration is sufficient, and more than 2 percent 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 composes more than 55 percent of the fowl's body and over 65 percent of the egg. In other words, a dozen

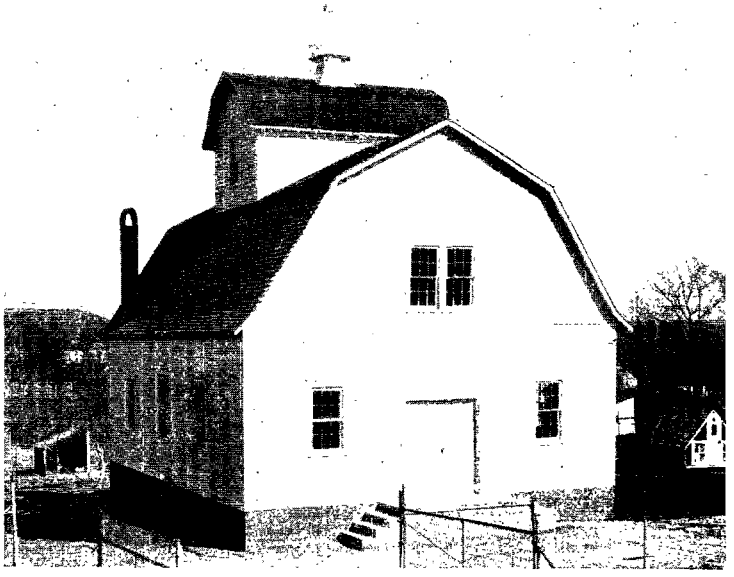

FIG. 19.—Nutrition building on the Kansas State College poultry farm. This building is equipped with storage bins, grinders, mixers, and elevators. The basement is used for brooding chicks in batteries until four weeks of age.

eggs weighing 1½ pounds contain 1 pint or a pound of water. Water also serves to cool the body, aids in digestion and absorption, and acts as a lubricant for the joints and muscles.

Palatability.—A fifth group contains the fresh, succulent, palatable feeds. The common sources of this group during the fall and winter are wheat or rye pasture, cabbage, and mangel beets. During the remainder of the year, alfalfa, clover, or sudan grass affords an excellent pasture. While these contain some important food materials, they are of particular value in stimulating the appetite and for their physical effect in the digestive tract. The green feeds in this group are one source of the pigment (xanthophyll) which gives the egg yolk a rich yellow color. A ration may contain

all of these essential nutrients required for growth and egg production and yet if it is not palatable, best results cannot be expected.

The supplying of some of the materials in each of the above groups is necessary in a complete ration whether it be for growing chicks, laying hens, or breeding stock.

The foregoing nutrients should be mixed thoroughly when fed as a growing or laying mash. The building used for mixing the experimental rations used at the college is shown in figure 19. It may be seen in the background in figure 1.

METHODS OF FEEDING

Methods of feeding vary with the kind of poultry and the purposes for which it is kept. The feeding of chicks, laying and breeding stock, and market poultry is discussed in the following pages.

Feeding Chicks. — After the hatch is completed, it is a good practice to transfer the chicks from the incubator to commercial chick boxes and leave them in these boxes at room temperature until they are 24 to 30 hours of age at which time they are old enough for their first feed. It is important that 20 to 25 chicks be placed in each compartment of the box in order to be comfortable and that two sticks an inch or more in thickness go between the boxes if they are stacked in tiers. When chick boxes are not available, the chicks can be kept in the incubators a short while after hatching before they are moved directly to the brooder. The first feed after the chicks are placed around the brooder, consists of sharp grit and milk or water. It is well to dip each chick's beak in the liquid when placing it under the brooder in order to teach it to drink. The chicks are taught to eat mash by placing small amounts on egg case cup flats, shingles, or boards and tapping gently to attract the chick's attention. As they gather around the feed, the more apt ones will begin to eat and they in turn will teach the others. After three or four days the feed is placed in shallow feeders and covered with wire as illustrated in figure 13. Still larger feeders should be substituted when the chicks are four and six weeks of age. There should always be sufficient hopper space so that one half the chicks can eat at any one time. After the chicks are old enough to receive mash and grain, both should be kept before them continuously in nonclog, nonwaste hoppers. This is more sanitary than to scatter grain in the litter which is not always clean. The chicks should be examined frequently the first few days of brooding and steps taken to prevent them from eating too much sand or litter, to avoid crowding, and to make certain that all of them are eating and drinkly normally.

The method of feeding used and recommended by the Kansas Agricultural Experiment Station consists of an all-mash feed the first four weeks and mash and grain thereafter. The mash being higher in protein than grain gives slightly better results if fed during that period in the chick's life when the most rapid growth occurs.

The Kansas State College standard chick **starting and growing** ration is as follows:

DRY MASH	Lbs.
Yellow corn, ground	30
Wheat, ground	16
Bran or shorts	16
Oats, ground	16
Meat and bone scraps	10
Dried buttermilk (*a*)	5
Alfalfa-leaf meal	5
Salt	1
Cod liver or sardine oil	1
Total	100

SCRATCH GRAIN	Lbs.
4-16 weeks:	
Cracked corn, kafir, or milo	50
Wheat	50
Total	100
17th week and after:	
Shelled corn, kafir, or milo	50
Wheat or barley	50
Total	100

(*a*) If skim milk or fresh buttermilk is available, supply all the chicks will drink, omit the dried buttermilk in the above mash mixture and replace with 5 pounds of bran. Keep the milk before the chicks the first month or longer if it is plentiful or until fly season when it should be discontinued since milk attracts flies, which are carriers of the eggs of tapeworms that infest poultry. It is not necessary to supply water while milk is being fed.

For feeding broilers, the above dry mash will promote faster growth if used alone for the first six to eight weeks; however, for chicks to be kept for laying and breeding stock, one should begin feeding the scratch grain after the chicks are four weeks of age. When the chicks can have access to direct sunlight a few minutes each day that the sun shines, the fish oil is not essential for good results. If, however, there should be two or more weeks of continuous cloudy weather, then fish oil should be added at the rate of 1 percent of the ration. Only tested oils with a high biological rating for vitamins and not more than 3 percent free fatty acid should be used. When whole grains are to be fed as scratch grain after the birds reach maturity, it is advisable to accustom the young stock to shelled corn when 16 to 18 weeks of age. In this way there will be no slump in development when the pullets are transferred to their permanent laying quarters. The above ration will be satisfactory until the pullets are about ready to lay, at which time they should receive a laying mash. (See page 39.)

Feeding Laying and Breeding Stock.— 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 fed regularly either by scattering it in deep litter, by placing in V-shaped wooden troughs, or by feeding continuously in open hoppers similar to the method used for supplying mash. The last two methods are gaining in favor on account of better sanitation. The hopper feeding of grain has been more successful with Leghorns than with the larger breeds. In either case it is recommended only for flocks bred for high egg production. When grain is fed in the litter, the requirements for 100 hens is 5 pounds in the morning and 7 pounds in the evening if fed twice daily or 12 pounds in the evening when fed once daily. The hopper feeding of shelled yellow corn, dry mash, and wheat to 400 White Leghorn hens and pullets two different years at the Kansas Agricultural Experiment Station showed an average consumption of 10, 33, and

57 percent of corn, mash, and wheat, respectively, and this ratio varied but little for the different seasons of the year.

The Kansas State College standard ration for **laying and breeding stock** is as follows:

DRY MASH

	Pounds	Percent
Corn or kafir } ground together	100	23.5
Wheat or milo } ground together	100	23.5
Oats or barley } ground together	100	23.5
Meat and bone scraps (a)	75	17.6
Alfalfa-leaf meal	45	10.6
Salt	5	1.2
Total	425	99 9

SCRATCH GRAIN

	Lbs.
Shelled corn, kafir, or milo	200
Wheat or barley	200
Total	400

(a) This ration can be slightly improved by replacing 25 pounds of meat and bone scraps with an equal amount of dried buttermilk. If skim milk or fresh buttermilk is available, feed 3 to 4 gallons daily per 100 hens and omit 50 pounds of meat and bone scraps.

One hundred hens will consume an average of about 22 pounds of grain and mash daily. For eastern Kansas the corn, wheat, and oat combination is generally used while for the western part of the state, kafir, wheat or milo, and barley being more abundant can be used with equally good results provided a good grade of green alfalfa-leaf meal or a satisfactory substitute is available to supply the vitamin A requirements. It has been proved by experiments that good-quality kafir or milo can replace either white or yellow corn pound for pound in a ration for growing chicks or laying hens when adequately supplemented with other nutrients, especially vitamin A.

There is some misunderstanding as to what constitutes alfalfa-leaf meal. A definition adopted in 1928 by the Control Division, State Board of Agriculture, Topeka, Kan., is as follows: "Alfalfa-leaf meal is the ground product consisting chiefly of leafy materials separated from alfalfa hay. It must be reasonably free from other crop plants and weeds and must not contain more than 18 percent of crude fiber." Alfalfa meal, proper, is defined as "the product resulting from grinding the entire hay without the addition of any alfalfa stems, alfalfa straw, or foreign material, or the abstraction of leaves. It shall contain not over 33 percent crude fiber."

It has been found that a fourth or fifth cutting of alfalfa hay when properly cured without too much bleaching, can be ground and used as a substitute for the leaf meal. This product usually contains less than 20 percent crude fiber and more than 20 percent crude protein. Alfalfa-leaf meal is used as a source of provitamin A during that portion of the year when the flock does not have access to green pasture. The latter is preferred when available.

Because of enzyme action the provitamin A content in alfalfa hay and meal deteriorates rather rapidly. This seems to be true whether the hay is cured in a machine, in the sun, or in the shade. The presence of a bright green color is not a sure guarantee of a high percentage of provitamin A. The time may come when a

guaranteed provitamin A content is required on commercial lots of alfalfa-leaf meal of different ages. Other things being equal, the fresher the product the better.

Wheat or rye pasture during the fall, winter, and spring, and alfalfa or sudan grass pasture for the summer months will provide ample green feed throughout the year. It is when these forms are not available or when the layers are confined to the houses that it is necessary to incorporate a good grade of alfalfa meal in the ration.

Oats and barley will grind easier and finer if mixed with one or more other grains such as corn, kafir, or wheat.

The amount of the different grains suggested in the above mixture does not have to be adhered to rigidly for good results. One's practice should be governed somewhat by the prices of feed. When any one grain is selling at a price out of proportion to its nutritive value as oats and barley were in 1935, wheat bran can be substituted, or 100 pounds each of bran and shorts can replace an equal amount of ground oats and wheat. When wheat is selling for considerably more than corn, kafir, or milo, it can either be reduced in amount, or omitted from the scratch grain. Table II gives the total digestible nutrients in 100 pounds of several different feeding stuffs used in preparing poultry rations.

TABLE II.—THE NUMBER OF POUNDS OF TOTAL DIGESTIBLE NUTRIENTS IN 100 POUNDS OF FEEDING STUFFS. (*a*)

FEEDING STUFF.	Total digestible nutrients in 100 lbs.	FEEDING STUFF.	Total digestible nutrients in 100 lbs.
Alfalfa, hay	51.6	Meat scraps	71.4
Alfalfa, green	11.7	Molasses, blackstrap	59.5
Barley	79.4	Mangels	7 4
Buckwheat	63.4	Oats, grain	70.4
Blood, dried	71.1	Oats, silage	17.3
Buttermilk	8.4	Potatoes	17.1
Beets, common	10.2	Rye, grain	81.0
Corn	85.7	Sorghum, grain	79.5
Cottonseed meal	75.5	Soybeans	94.1
Cabbage	7.9	Soybean meal	84.5
Fish meal	58.8	Skimmilk	9.1
Feterita, grain	80.9	Turnips	7.4
Hominy feed	84.6	Wheat	80.1
Kafir, grain	80.0	Wheat bran	60.9
Milo, grain	79.9	Wheat shorts	69.3
Millet, seed	77.5	Whey	6.2

(*a*) These figures are taken from Table III, pages 413-422 of Feeds and Feeding, Abridged, Sixth Edition, by The Henry-Morrison Publishing Company, Ithaca, New York. By permission of the publisher.

These figures, however, do not tell the whole story. The quality of the nutrient present is of more importance than the quantity. For example, dried blood and meat scraps each contain 71 percent of digestible nutrients although the nutrients are of such a character that dried blood cannot be used to replace meat scraps for growing chicks as they cannot utilize it. It should also be understood that it is not so important that specific feeding stuffs be used in definite amounts as it is that a proper balance be maintained between feeds containing the necessary nutrients such as carbohydrates, fats, proteins, vitamins, and minerals. In this connection it should be kept in mind that an adequate diet is of no value unless it is palatable enough to be eaten by the chickens. Therefore, the palatabiliy of the feed must be considered. It should also be realized that the character of the feed should be suited to the digestive tract of the animal. The feed may be adequate and appetizing, but so bulky that a chicken could not eat a sufficient amount to give good results.

Fifteen to 20 percent of a good grade of meat and bone scraps, fish scraps, and dried milk added to almost any ground-grain mixture will give good results when supplemented with whole or cracked grains and vitamins.

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, 2 parts of scratch grain should be fed to 1 part of mash consumed. This is changed to equal parts of grain and mash in the spring and 2 parts of mash to 1 of grain during the summer. Since in the fall, pullets are both growing and producing eggs, there is an unusual demand for feed. The pullets can best be induced to consume this feed for this dual demand by using a larger amount of whole grain which is more palatable than ground grain. Care must be taken, however, to see that the mash which contains the supplements (proteins, vitamins, and minerals) is consumed in large enough quantities to meet the body's demands. When the pullets are mature and nutrients are no longer needed for growth, the amount of whole grain can be reduced. The all-mash system of feeding laying hens has not given satisfactory results at the Kansas Agricultural Experiment Station. There is too much of a tendency with this method of feeding for hens to lose weight when in full production. Better results might be obtained with this system where artificial lights are used to lengthen the feeding day. All-mash feeding calls for 24 feet of hopper space per 100 hens, whereas with grain and mash feeding, 10 feet of mash hopper space will suffice.

The pellet feeding of laying hens showed no advantages over feeding an all-mash ration in a comparison made a few years ago by Helen M. Molyneux at Harper Adams Agricultural College, Newport, Salop, England. In fact the three lots of pullets on all-mash feed averaged 178.4 eggs the first year compared with three lots of pellet-fed pullets which average 169.8 eggs. While this difference is

not significant, it shows no advantage to pellet feeding. The total margin of income was about $50 more for the all-mash fed lots because of the higher cost of pellet feed. In other words, the conversion of mash into pellets adds about 10 cents per hundred to the cost of feed without improving its nutritive value.

Feeding Market Poultry. — The pen method of fattening is the most practical one on the farm. The chickens are confined in small clean pens and hopper fed for three to six weeks on shelled or cracked yellow corn. Condensed buttermilk should be added to the grain at the rate of 3 to 4 pounds a day per 100 birds and excellent results will usually be obtained in four to five weeks. Liquid milk fed as a beverage can be used when available as a substitute for the condensed form. For quicker results, finish the birds for 10 to 14 days on a liquid milk mash. In this system the whole grain 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 when broilers are for home use, local trade, or when they 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 it is possible (1) to distinguish hens which are laying from those which are not, (2) to 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 (3) to 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 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 detect 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 and experience.

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 face gives a lean, clean-cut appearance with prominent clear eyes and an absence of wrinkled skin about the head. The vent of a hen that is not laying is small, puckered, dry, and yellowish in color. The head is inclined to a beefy appearance, with full face, thick eyelids and eyebrows, and a small comb which is usually cold to

the touch. (Fig. 20.) 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 hen molts or sheds her feathers, the more she has laid. A hen which produces four or five eggs a week 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.

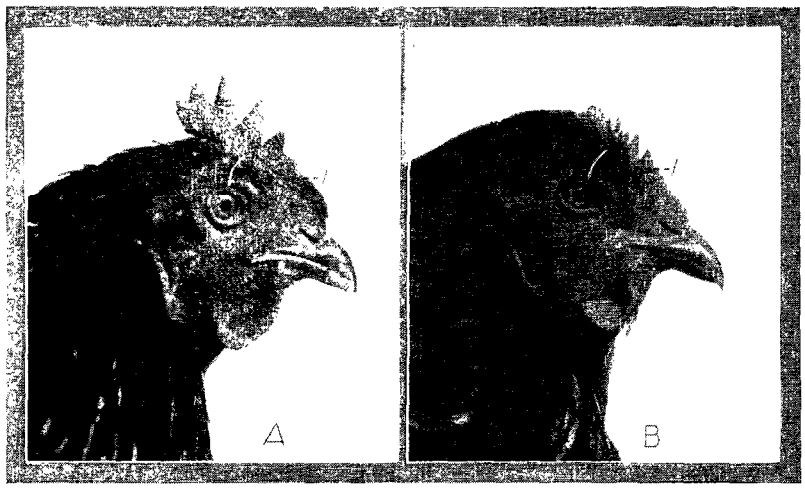

FIG. 20.—Heads of a high producer (A) and of a low producer (B). Note the well-developed comb, wattles, and earlobes, the full eye and the short and well-curved beak of (A) and the beefy head, prominent eyering, and sunken eye of (B).

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, frayed 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 is 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 and taken 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 to fall. This is a normal process which man cannot change except to lessen the number of eggs produced.[4]

4. For full information on culling, the reader is referred to Circular 147 of the Agricultural Experiment Station, "Culling Poultry."

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 problem in market-egg production is to produce large marketable 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 at this season unless they are forced through a summer molt or are given artificial illumination after August 15. 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 normally will lay in August and September and then are likely to stop and go through a fall molt similar to the course followed by the older hens. Therefore, in the middlewest 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 middle of April for heavies and during the month of April for Leghorns. It is always 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.

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 angle 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 accomplished by adding meat and bone scrap or milk in some form in the mash, as a substitute for 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.

The egg shell normally contains about 7,000 pores which are sealed with a cuticle or bloom that is soluble in water. When the egg is washed, the bloom dissolves and exposes these openings to the atmosphere. This process both hastens evaporation of the contents of the egg and permits decaying bacteria and objectionable odors to more readily enter the egg. Therefore, the keeping quality of eggs is greatly reduced when they are washed, and provisions should be made to keep the number of dirty eggs 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 carried 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 readily if kept clean, hence the losses are small compared with fertile eggs which spoil quickly when kept at a temperature above 68° F.

Market eggs should be gathered twice daily and kept in a clean, cool room 24 hours before casing. Place the small end down in the case. It has been demonstrated by Professor E. M. Funk at the Missouri Agricultural Experiment Station that eggs will cool much faster in a wire basket than when held in a bucket or egg case. In this work all eggs were heated to temperatures ranging from 92 to 102° F. and then transferred to a room the temperature of which was 50° F. The time required for the temperature in the center of the eggs in different containers to reach 68° F. or below is shown in Table III and figure 21.

These results show that eggs in a wire basket had cooled to a temperature below 68° F. in five hours whereas eggs in a galvanized pail required 10 hours and eggs placed in a warm case required four times as long or 20 hours. The chick embryo in a fertile egg is rapidly developing during the 25 hours the egg is passing down

TABLE III.—EFFECT OF CONTAINER ON COOLING EGGS IN AN EGG ROOM (50° F.)

Data from E. M. Funk

HOURS.	Single egg.	Wire tray.	Wire basket.	Galvanized pail.	Chilled case.	Warm case.
0	101.0	102 0	100 0	98 5	97.2	92.0
1	**61.1**	86.9	96.0	97.9	96.2	91.8
2	51.3	74.4	87.2	95.9	94.5	91.3
3		**66.5**	79 1	92 2	92.0	90.2
4		61.0	72.7	87.0	89.8	88.6
5		56.5	**67.5**	82 1	87.5	86.1
6		55.4	63.6	77.7		
8		51.9	58.5	70.6		81.0
10			56.5	**65.6**	76.5	75.5
12			54 7	62.2		
14				59.8		69.8
18					**64.5**	
20					62.2	**63.1**
24					59.4	59.6
28					57.0	56.7

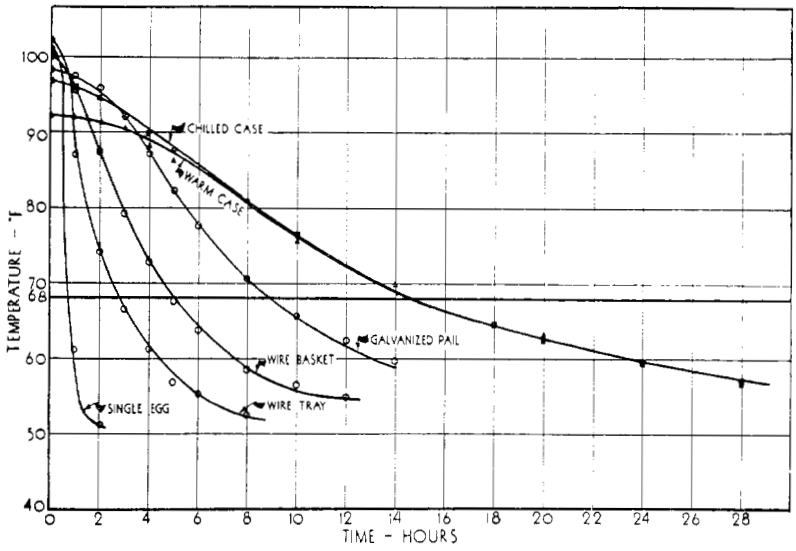

FIG. 21.—Graphs showing time required for the interior of an egg to cool from approximately 100° F. to below 68° F. when held in the different containers indicated. (Courtesy Mo. Agr. Expt. Sta.)

the oviduct before it is laid, and during the summer months it often remains in the nest at incubation temperature five hours or more before it is gathered. If an additional 20 hours elapse in the egg case before development is checked there will be a total of 50 hours of incubation before chick growth is arrested.

Such conditions interfere with the quality of the egg. Since very few producers have an egg storage room with a temperature of 50 degrees, the thing that usually happens is that eggs in warm weather are frequently never cooled below 68° for the week or more they are held before marketing. This should convince one that a suitable store room, such as a well-ventilated cave or cellar, would be an asset to those who produce eggs for market purposes.

Kansas farmers receive less per dozen for their market eggs than do the farmers in any of the other states with the exception of two or three. One of the reasons for this is the poor quality of Kansas eggs during the summer months. When eggs in this state are properly cared for they sometimes sell for more on the New York City market than the best California eggs. This fact was demonstrated a few years ago when a former Kansas State College student living in New York purchased market eggs, received from Washington county, Kansas, and Petaluma, California. The best grade was asked for from the two states. The retail price per dozen the middle of March for the eggs from California was 29 cents whereas the Kansas eggs cost 37 cents.

A suitable cellar for maintaining egg quality at all seasons of the year is illustrated in figure 22. This cellar is equipped with an air

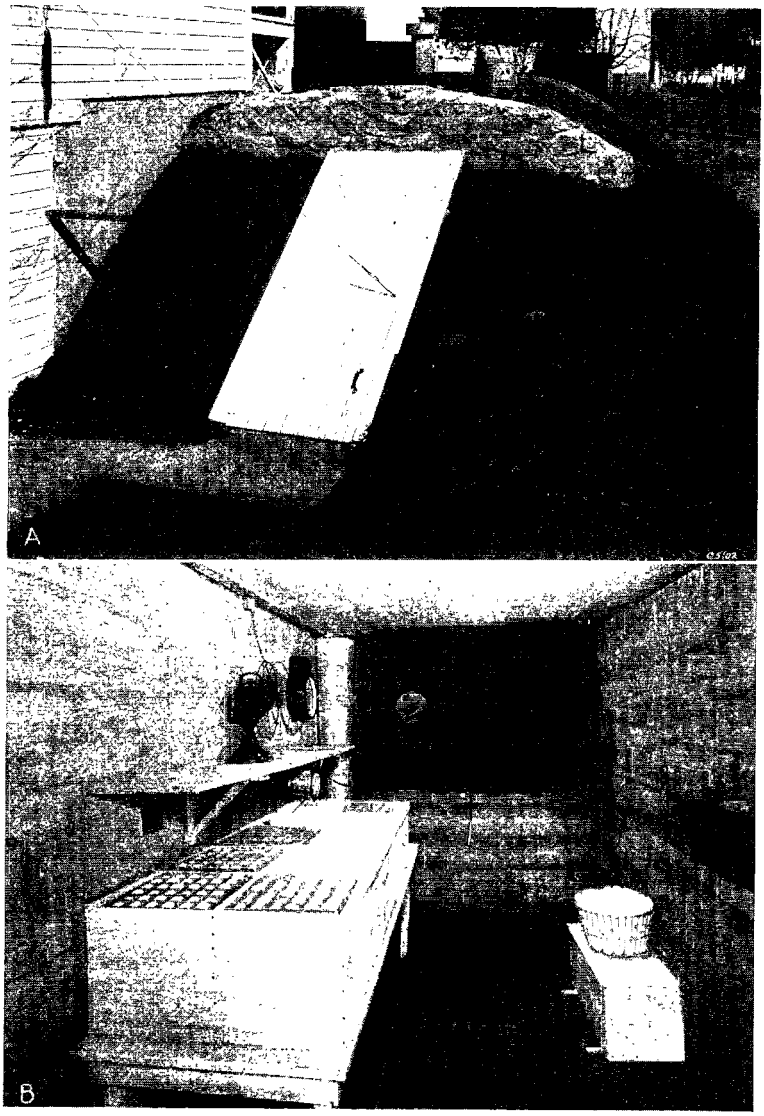

FIG. 22.—(A) Outside view and (B) inside view of a cellar for holding eggs for market. The air intake and revolving air outlet are shown in (A). The wire basket in (B) is for thoroughly cooling eggs before casing. The burlap sack absorbs water which drips from the pipe which supports it. The electric fan is to hasten evaporation. It is not essential, however, for good results.

intake shaft 10 inches in diameter to admit the cool night air near the floor. A 10-inch suction cupola at the opposite end from the intake removes the warm air from the ceiling. The floor is covered with 6 inches of clean sand which is kept saturated with well water to add humidity to the room and thus check the loss of moisture from the eggs. The sand is covered with 2"x 2" lattice or boards spaced 2 inches apart to walk on. The sand floor and an air intake near the floor, which are the principal features of this cellar, could be installed in most farm cellars at very little cost. Such an arrangement insures good ventilation with an absence of stale, musty, or dank atmosphere.

TEMPERATURE RECORDS IN AN EGG CELLAR

A continuous day and night temperature was taken outdoors and in the cellar illustrated in figure 22 in July, 1935. Two humidity readings were also taken daily with a sling psychrometer. The results are given in Table IV. The temperature and humidity represented by these figures should keep eggs in excellent condition for a week or longer.

Grading Eggs. — The Bureau of Agricultural Economics, United States Department of Agriculture, has formulated standards for individual eggs which have come into general use as a basis for the establishment of grades designated by different trade names. The specifications of each egg-quality factor are given in Table V.

TABLE IV.—THE AVERAGE TEMPERATURE AND HUMIDITY INSIDE AND OUTSIDE OF AN EGG CELLAR, JULY, 1935

DATE.	Temperature, F.			Humidity, percentage.		
	In cellar.	Outdoors.	Difference.	In cellar.	Outdoors.	Difference.
1- 7	66.37	85.89	19.52	87.7	53.9	33.8
8-14	67.77	86.77	19.00	87 8	43.2	44.6
15-21	68.20	86.50	18.30	85 5	40 4	45.1
22-25	71.97	87.20	15.23	86.3	43 2	43 1
Average	68.58	86.59	18.01	86.8	45.2	41.6

Eggs stored in this cellar one week deteriorated in market value 38 cents a case or 5.6 percent; whereas eggs stored above ground in a north room with openings on four sides, during the same week deteriorated $1.15 a case or 18.7 percent of the original value.

TABLE V.—A CHART GIVING THE U. S. STANDARDS FOR INDIVIDUAL EGGS

QUALITY FACTORS.	Specifications of each quality factor.			
	U. S. Special.	U. S. Extra.	U. S. Standard.	U. S. Trade.
Shell	Clean; sound; normal.	Clean; sound; normal.	Clean; sound; may be slightly abnormal.	Clean; sound; may be abnormal.
Air cell	One eighth inch or less in depth; regular.	Two eighths inch or less in depth; regular (*a*).	Three eighths inch or less in depth; may show movement not in excess of one half inch.	May be over three eighths inch in depth; may show movement in excess of one half inch; may be bubbly or free.
Yolk	Well centered; outline indistinct; motion sluggish; free from visible germ development and other defects or blemishes.	Fairly weak centered; outline moderately defined; may be slightly mobile; free from visible germ development; and practically free from other defects or blemishes.	Outline well defined; may be mobile; may show slightly visible germ development and other definite but not serious defects.	May be plainly visible; may be freely mobile and cast dark shadow; and show clearly visible germ development but no blood; may show other serious defects.
White	Firm; clear.	Firm; clear.	Reasonably firm; clear.	May be weak and watery.

(*a*) Eggs which otherwise fully meet the specifications of U. S. Extra but have slightly tremulous air cell (a movement not in excess of ⅛ in.) may be classed as U. S. Extras in the retail grade of U. S. Extras.

MID-WEST QUALITY EGG PROGRAM

The following Quality Egg Program was adopted by representatives of the State Colleges of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Missouri, Iowa, Minnesota, Wisconsin, Illinois, and Ohio in January, 1933:

I. Breeding:
   1. Use stock bred for large egg size.
      a. Large eggs are those weighing at the rate of 24 ounces or more per dozen.
   2. Use birds approximating standard body weight to produce standard size eggs.
   3. For hatching, use eggs of desirable size, shape, and color.

II. Feeding:
   1. Liberal use of a complete ration.
      a. Grains should be supplemented with suitable protein concentrates, minerals, and vitamins.
      b. Provide a liberal supply of either milk, water, or both.
   2. Feed mash in hopper and grain in hopper or clean litter.
   3. Feed to produce a golden yolk egg.
      a. Vary amount of alfalfa or succulent green feed in proportion to amount of yellow corn in ration.

III. Management of Flock:
   1. Produce clean eggs.
      a. Provide plenty of clean litter on floor.
      b. Use clean nesting material.
      c. Provide droppings boards with wire netting under roosting poles.
      d. Keep hens out of nests at night.
   2. Produce infertile eggs.
      a. Sell or confine breeding males by May 15.
      b. Keep young cockerels away from laying flock.
   3. Confine flock until noon.
      a. Birds should not be turned out at noon in wet or extremely cold weather.
   4. Provide a comfortable house and adequate equipment.
      a. Provide 3 to 4 square feet of floor space and 7 to 9 inches of roosting space per bird, 1 foot of mash hopper space to every 7 birds, and 1 nest for every 6 hens.
   5. Confine broody hens.

IV. Care of Eggs:
   1. Gather eggs two or more times daily.
   2. Cool eggs before placing in case.
   3. Hold eggs in a place where the temperature is from 45 to 65 degrees Fahrenheit. The air should be fairly moist. No objectionable odors should be present.
   4. Pack eggs large end up.

V. Selling:
1. Market at least twice a week.
2. Protect eggs enroute to market (from hot sunshine, cold, rain, and jarring).
3. Deliver eggs to dealers in substantial cases with clean flats and fillers.
4. Sell on a graded basis.
5. Sell to dealers properly equipped to handle eggs.

Confinement Versus Free Range. — Greater egg production can be obtained by keeping the pullets confined in the house from October 1 to May 1. When all the essentials for egg production are supplied, including 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 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.

Artificial Illumination. — The intelligent use of artificial lights will increase egg production among hens or pullets during the fall and winter months. Experiments at the Kansas Agricultural Experiment Station have shown that lights paid well when used on Leghorn hens, but pullets under lights were less profitable than those without lights. In this test the hens received artificial lights beginning August 15, and the pullets October 1 and continued to April 1. The lights were turned on at 4 a.m. While the lighted pullets laid better during the fall and winter they slumped in egg production during the late spring at which time the pullets without lights surpassed them in both number and value of eggs laid during the year.

When lights are employed, it is recommended that morning lights be used from 4 to 5 a.m. to daylight. If grain is fed in the litter, 40-watt Mazda electric lights with 16-inch reflectors should be placed 6 feet above the floor and 10 feet apart. If grain and mash are fed in hoppers, 25-watt lights placed over the feed hoppers will suffice. However, much remains to be learned about the best size of lights to use. The old theory that a lengthened day and increased feed consumption were responsible for increased egg production has been questioned. It now appears that both the quantity and quality of light are associated with increased fecundity. Additional experimental work will be required to establish the facts regarding this problem.

Lights are used from the middle of August for hens and October 1 for pullets to April 1. It should be remembered that the greatest value from lights comes from a change in the distribution of egg

production rather than in a greater egg yield. Production is increased during the fall and winter and decreased during the late spring and summer months. The annual production is not changed materially.

Lights are usually begun and discontinued gradually, that is, a week or more is required to start and stop the lights. While this may be desirable, its importance has probably been overemphasized. What is more essential is that the birds have plenty to eat and drink when the lights go on in the morning and that regularity be strictly observed in their management. Some method should be used to prevent the water from being frozen when the lights come on in the morning. (See "Electric Wiring," page 19.)

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 to large cities. Only one third of the live weight of a broiler is edible.

The principal items which enter into the high cost of winter 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 cod-liver oil, which makes it possible to grow broilers in confinement, has increased the chances for success by reducing leg weakness and high mortality. Slipped tendons or perosis caused considerable trouble until it was found that the reduction of phosphorus in the ration to less than 1 percent would eliminate most of the disorder. (See fig. 24.)

While both sexes of any of the general-purpose breeds are used in broiler production, now that sexed chicks are available it would be to the producers' interests to use male chicks only, as they grow faster than the females. Hybrids or first-generation crosses are also popular for broiler production. Rhode Island Red males crossed on Barred Plymouth Rock or White Leghorn females will produce broilers of good size at 10 weeks of age.[5]

CAPONS

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

The cleanly castrated male can be recognized by his small refined head without a red comb; by his failure, as a rule, to crow; by his

5. For full information on crossbred poultry, the reader is referred to Bulletin 252 of the Kansas Agricultural Experiment Station, "Crossbred Poultry."

increase in size when mature; and by his long, silky neck, back, and tail feathers.

Rhode Island Reds, Plymouth Rocks, crossbreds, and Brahmas are among the most popular breeds used as capons. They should be operated on when eight to ten weeks of age at which time they weigh 1¼ to 1⅓ pounds. (Fig. 23.) 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.

FIG. 23.—A group of vocational agriculture teachers taking "post graduate" work in caponizing.

Capons will consume about 50 pounds of grain and mash each to eight months of age at which time they should weigh 8 pounds each. The number of slips, which are imperfectly castrated males worth about one half as much as capons, will range from 10 to 20 percent of the flock. One can also expect 10 to 20 percent mortality. These facts should be taken into consideration when calculating the cost of producing capons.

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.[6]

6. Details regarding the operation of caponizing may be secured by writing the Agricultural Experiment Station, K. S. C., Manhattan, Kan.

MARKETING POULTRY PRODUCTS

Poultry and egg buyers can be found in a town of any size. Some send trucks into the country and buy direct from the farm. Others receive at their stations in town, while some do both. The problem confronting the farmer is how and where to sell to secure 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. — The method most generally practiced in marketing eggs in Kansas is to sell directly to produce buyers and packers some of whom buy on a graded basis. Cash is paid for the eggs and the entire offerings of each farm are taken, regardless of the volume. Keen competition in this field has a tendency to hold the price up to the full market value. While there has been much improvement made in the quality of market eggs produced in Kansas, the reputation of Kansas eggs in eastern markets is not so favorable as it should be. Producers, buyers, and shippers should be interested in improving this situation.

Eggs carry better and are 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 well-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. Attractive signs 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 purchases.

Two other methods of marketing eggs in eastern states are: (1) Cooperative shipping and (2) egg auctions.

Cooperative Shipping of Eggs. — The cooperative shipping of eggs as described by Mr. E. R. Menefee in Bulletins 357 and 390 of Purdue University Agricultural Experiment Station, Lafayette, Ind., showed that producers received several cents per dozen net more for eggs shipped to eastern markets than was paid on their local markets. In this plan the eggs are gathered, graded, and packed in 30-dozen cases at the farm. The cases are labeled by the producer who consigns them to his selected receiver in New York City. The cases are delivered direct to a refrigerator car, where they are loaded and sent by fast freight to their destination. The car is unloaded by a bonded trucking company and the eggs are delivered to the jobbers or receivers specified on the cases by the shippers. The eggs are inspected, a price is determined, and usually

checks are mailed to the producers in time to be received five days after shipping.

Now that refrigerator trucks are available, this system should have greater possibilities in the future than it has had in the past.

Egg Auctions. — Egg auctions were begun in New Jersey in April, 1930. The idea proved to be so popular that 20 auction markets are now functioning in seven eastern states. Eggs of a definite quantity and quality are offered by producers on the auction market. They are sold to the highest bidder and the returns, less a percentage charge to cover operating costs, are made to the producer. This charge varies from 3 to 6 percent of the gross sales depending upon the amount of grading, inspection, and casing necessary after the eggs reach the auction room. Egg auctions have stimulated better management of poultry flocks and the careful grading of eggs, for which producers have been compensated by increased revenue from the products sold.

Auctions to be successful should be located in thickly populated areas. There are advantages in having them centrally located to both producers and buyers. In this way poultrymen soon obtain first-hand information as to the buyers' needs, and the location must be convenient to attract a large number of merchants who desire to buy fresh eggs of high quality.

It is impossible to say whether or not either of these methods could succeed in Kansas. There are, however, some favorable locations where they might do very well.[7]

MARKETING POULTRY

Chickens are kept primarily for the production of eggs. When no longer useful for this purpose, they are usually eaten or sold. The percentage of different classes in cars of live poultry unloaded in New York City in 1930 was: Fowl, 69.4; chickens (2½ to 3½ lbs.), 20.8; broilers, 3.5; cocks, 1.7; ducks, geese, turkeys, and capons, less than 1.7 each. Contrary to common opinion, broilers amount to only 3.5 percent of the total live poultry market receipts.

Hens under 4 pounds in weight are not in demand and for that reason are discriminated against. White- or buff-colored plumage on all classes of market poultry is preferred, as the birds have a better appearance when dressed in the pin-feathery stage. Roasters and capons are usually dressed when the feathers are fully developed, so, with these, light color is less important.

Live Poultry. — Market poultry is most frequently sold alive from the farms in this section. 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, to

7. Those interested in egg auctions should write for Circular 195, "Marketing New Jersey Eggs," published by the State Department of Agriculture, Trenton, N. J.

avoid dockage 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 percent in a 100-mile shipment.

When shrinkage, mortality, dockage for slipped tendons (fig. 24) and barebacks, and delay in payments are taken into account, little is gained by shipping very far when the premium is not more

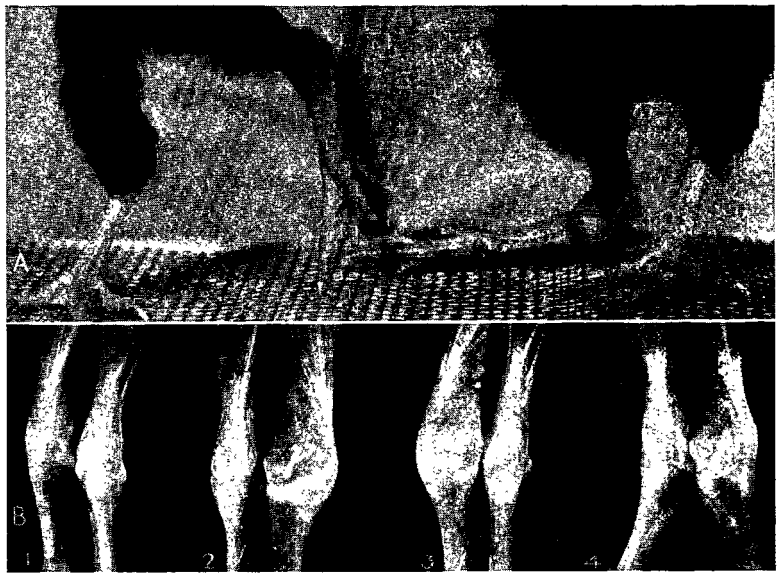

FIG. 24.—(A) Deformed condition of legs of broilers. (B) Hock joints of broilers showing slipped tendons. (1) The normal condition, (2) the tendon has slipped from the condyle on the right leg, (3) the tendon has slipped on the left leg, and (4) tendons have slipped on both legs. An excess of phosphorus in the ration will cause this condition.

than a few cents more per pound. By selling at the door or to a local buyer 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.

Dressed Poultry.—The practice of fully dressing, drawing, and cutting up poultry has developed in many sections of Kansas the past few years. This is done where producers sell direct to consumers. One can buy in some Kansas markets a fully drawn bird ready to roast, or any portion of the chicken desired, such as the breast, thigh, drumstick, wing, back, neck, or giblets. This practice has many advantages. It eliminates the drudgery on the part of consumers of preparing poultry for cooking. It is just as easy to

serve a piece of chicken, duck, goose, or turkey purchased in this form as it would be to serve a pork chop or a steak. Small families do not care to invest a dollar or more for a whole chicken. By disjointing the springer, fowl, or cock, the consumer can buy any portion and amount desired at small cost and without having the problem of utilizing left-overs for future meals.

The price charged for different portions of the bird should be fixed so as to enable one to dispose of all parts at the same time. Experience has shown that 10 cents per bird is a sufficient charge for cutting it into parts. For example, a 5-pound dressed and drawn fowl worth 30 cents a pound would sell for $1.50. When cut up and sold in small quantities it should bring $1.60. One Topeka, Kan., dealer charged 45 cents a pound for breast meat, 40 cents for thighs and giblets, 35 cents for drumsticks, 25 cents for wings, and 23 cents for backs and necks. These prices enabled him to dispose of all parts at approximately the same time. While these prices will vary in different parts of the state, the ratios in the value of different parts should remain about the same.

Any practice which will stimulate greater consumption of poultry in the Middle West should be encouraged so it will reduce the receipts of poultry on the Atlantic seaboard where prices are made. Since the price paid for poultry products in this section is based on the prices paid on the east coast, it would be to the producer's interest to encourage local consumption as much as possible in order to obtain more for his poultry products whether sold to local consumers or to produce men.

Killing and Dressing Poultry. — Poultry should be properly starved, killed, bled, plucked, and drawn if it is to reach the consumer in the best possible condition in flavor, appearance, and state of preservation,

Feed should be withheld 12 to 15 hours in order to empty the digestive tract of solid matter before the birds are killed. Water is supplied to within an hour or two of slaughtering. The birds may be killed by "sticking" the brain and bleeding, by dislocating the neck, or by beheading. The birds can be dry picked with the "stick" method of killing whereas scalding is necessary for birds killed by either of the last two methods. It is a common mistake to overscald poultry. Water heated to 135 to 140° F. is hot enough to loosen the feathers without breaking the epidermis or outer layer of skin, provided the birds are left in the water one minute. The lower temperature is used for broilers and fryers and the higher for older birds. In slack or semiscalding, the water is heated to 128° F. and the birds, which have been stuck in the brain to loosen the feathers, are agitated in it for 30 seconds, after which they are hung up to drain and to be plucked.

Adhesive Method of Plucking. — A commercial wax which melts at a fairly low temperature is now available for plucking poultry. Birds are killed and partially picked or "roughed" in

the usual way, preferably slack scalded, allowed to dry, and then dipped twice in a vessel of melted wax kept at a temperature of about 126° F. Cold water is then sprayed on the birds to harden the wax quickly after which it is "peeled" off the carcass. The pin feathers and hair are removed with the wax, leaving the birds in an attractive, clean condition ready to be drawn or disjointed. The wax can be reclaimed with a 2 to 3 percent loss by heating and skimming off the scum of feathers and down. This process is patented. A license for its use can be obtained from the patent holder. The method is used rather extensively in large killing and dressing plants. Whether or not it will come into general use by small operators remains a question.

Drawing, Trussing, and Disjointing.— A bird is said to be dressed when it has been killed, bled, and plucked. Further preparation for cooking involves singeing, brushing, drawing, and washing. Removal of the internal organs is referred to as drawing or eviscerating. Fastening the legs and wings to the body of a roaster is referred to as trussing. Fryers, fowls, and cocks are usually disjointed or cut into small pieces for frying or stewing. Roasters are eviscerated through an opening cut across the abdomen, while broilers are usually split down the back, after which the entrails are removed and the bird is left intact.

A good method of procedure in drawing and trussing a roaster is given below. Although it is not necessary to remove tendons, wishbone, and to disjoint the drumstick from the thigh, these features are included.

A. Preparation for Drawing:
   1. Singe over an alcohol, gas, or paper flame.
   2. Brush.
   3. Pull tendons and remove shanks at hock joints.
   4. Cut down back of neck.
   5. Remove crop, gullet, windpipe, and head.
   6. Cut neck from body at shoulders.

B. Drawing:
   1. Insert first finger and loosen the lungs.
   2. Remove wishbone.
   3. Make incision around vent, wrap vent with paper.
   4. Cut across abdomen.
   5. Insert first and second fingers and draw.
   6. Separate giblets (heart, liver, and gizzard) from intestines. Wash carcass.

C. Trussing and Finishing:
   1. Disjoint drumstick from thigh.
   2. Place giblets, neck, wishbone, and fat into body cavity.
   3. Place end of drumsticks through slit and out vent opening.
   4. Draw neck skin over front opening onto back.
   5. Fold wings in place.
   6. Remove oil sac at base of tail.

Mature birds will shrink about 10 percent in weight when bled and plucked and an additional 20 percent when drawn and trussed ready to cook. The amount of edible meat on the bird ranges from 33 percent of the live weight of a broiler to 50 percent for the hen and 56 percent for the capon, according to figures reported by the Iowa Agricultural Experiment Station.[8]

POULTRY PARASITES

Poultry parasites are classed as external and internal. 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

Lice. —Lice belong to that class of parasites which lives on the fowl's body throughout the year. There are several species, but the habits of and treatment against 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 is in the discomfort caused by the crawling parasites which make the birds uneasy and perhaps cause 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 1 ounce per gallon and used as a dip gives good 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 above methods require handling of individual birds. A more recent method of treating the entire flock without handling the birds has been developed. Nicotine sulphate, sold under the trade name of "Black Leaf 40," when applied as a thin film to the upper surface of the roosting poles in the evening a few minutes before they are occupied by the birds is very effective in controlling lice. It can be applied with a paint brush, an oil can, or with a "cap-brush" — a new device made especially for applying this material. The roosts should be scraped clean on the upper surface before treatment is applied. A second application in 10 days will kill the lice which have hatched since the first treatment. While this material is more expensive than sodium fluoride, less labor is required to apply it and it is not irritating to the human nostrils or disagreeable to handle. The thorough treatment of every bird twice a year with either of the above methods will keep the flock practically free of lice. Black Leaf 40 is very poisonous and should be handled with care.

Mites. — The red mite is a summer parasite which lives and reproduces in the poultry house, on the roosting poles, and in the

8. Additional information may be obtained on this subject by writing to the Agricultural Experiment Station, K. S. C., Manhattan, Kan.

nests. It migrates to the fowl's body at night, gorges itself 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.

Prevention of an infestation is simple and easy provided treatment is applied in time. Once the poultry house becomes infested, eradication is slow and difficult. To prevent mites becoming established in the poultry house, thoroughly paint once each year all surfaces and joints of the roosts and supports with an undiluted, heavy coal tar product such as carbolineum or creosote oil. Crude petroleum, while not so effective as either of the above products, is inexpensive and available in most localities. These products are usually too thick to spray, hence they are applied with a paint brush. Crank case oil is less effective but will do if used often enough. Application should be made early in the spring preferably in April. If treatment is delayed until after the house becomes infested, the above procedure should be followed after all litter, nesting material, and droppings have been removed and burned. Bedbugs and other parasites with similar habits are controlled in the same way.

INTERNAL PARASITES

The chief offenders among internal parasites are large and small round worms, tape worms, and coccidia. All three types are most serious among young chickens one to three months of age, but mature fowls may become badly infested.

It should be understood that all birds in a flock are not equally infested. These parasites are somewhat selective in choosing their hosts. Especially round and tape worms may be found in large numbers in some birds and practically absent in other birds in the same flock. The discovery upon autopsy of a heavy infestation in a few individuals is no indication that all birds are equally infested, nor is the absence of worms in a few specimens indicative of freedom from parasites by the entire flock. (Fig. 25.)

Round Worms. — While there are five or more species of round worms parasitic in poultry, the large white or yellowish nonsegmented worm which ranges from 1 to 4 inches in length is more common and causes more trouble than the others. It occupies that portion of the small intestine between the loop (duodenum) below the gizzard and the blind pouches (ceca) and is unattached to the intestinal wall after two or three weeks of age.

Tobacco dust containing 1 to 2 percent nicotine and fed in the mash at the rate of 2 percent for a period of three to four weeks has proved to be the most practical flock treatment on the farm. Some keep tobacco dust in the mash at all times. This treatment, however, does not remove all of the worms.

Carbon tetrachloride is recommended by H. W. Graybill and J. R. Beach of California as being almost 100 percent effective against, these parasites when administered in 1c.c. gelatin capsules and fed

at the rate of 3c.c. per adult bird. The dosage for younger fowls should be proportionally reduced.

Tape Worms. — There are many species of tape worms which vary from microscopic size to 10 inches in length. They are long, segmented, ribbon-like parasites which are more serious than round worms. The head, which is at the small end, is deeply anchored to the inner lining of the intestine and severe treatment is required to dislodge these parasites.

FIG. 25.—A demonstration of sanitation. (A) Chicks reared on worm-infested ground. This ground has been occupied by poultry for 55 years. (B) Chicks of the same age and reared on the same farm in a clean brooder house with sanitary runway attached. Note the increased size. (Farm of D. L. Roser, Burlington, Kan. Photographs by courtesy of G. D. McClaskey.)

There is no satisfactory treatment for the eradication of tape worms. Fifteen-grain tablets or capsules of crude kamala for mature, vigorous chickens or 7½ grains for weak or immature chickens given as individual doses are used more often than other remedies although there is good evidence that this drug is only about 1 per-cent effective for the removal of tape worm heads. This treatment is somewhat severe and some poultrymen feel that more harm than good results. When used, it should be given before the pullets come into production or while the hens are out of production. The mis-

take of feeding this drug to the pullets after they have begun to lay is often made. The result is a marked drop in egg production which may continue for several weeks. Poultrymen are inclined to tolerate a light infestation rather than take chances with the kamala treatment. The more logical plan would be to give individual treatment to those birds which show symptoms of infestation rather than treat the entire flock, unless it is known that a large percentage of the birds are suffering from tape worms.

Coccidia. — These organisms, which are microscopic in size, are quite different from round or tape worms, but being a serious pest, they are discussed here with the other internal parasites. Coccidiosis is a disease found most often in chicks two to 10 weeks of age, although older birds may suffer from it. The organisms usually congregate in the ceca or blind pouches or in the small intestine just below the gizzard. Red or bloody droppings are among the first symptoms. The coccidia are passed in the droppings and thus the disease spreads rapidly through the flock. A complete cycle from egg to adult requires eight to 10 days, however, only 24 to 48 hours are required from the nonifectious oöcyst to the infectious sporulated oöcyst stage in which condition it may infect chicks when taken into the body. Treatment consists of breaking this stage in the cycle by strict sanitation. Thoroughly cleaning and disinfecting the floor of the brooder house, hover, feed hoppers, and water fountains once a day will usually check coccidiosis in five or six days. The infected chicks should either be confined to the house or given clean ground daily to range on. This can be done by using a four-yard rotating system and turning the contaminated ground daily with a spade. The buttermilk flush is not necessary when the above suggestions are followed.

DISEASE AND SANITATION[9]

CONTROL OF DISEASES BY PREVENTIVE MEASURES

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 soon as discovered, and all birds which die should be burned immediately. Filth and refuse should not be allowed to accumulate, and poultry manure should be stored in a vault (fig. 26) or a sufficient distance to be hauled out of reach of both young and old birds. Dead animals or decayed meat is sure to cause trouble in warm weather if within reach of the chickens. Only when they have no alternative do chickens roost in filthy quarters and eat rotten and decayed feed.

9. For more complete information on poultry parasites and diseases, and control measures, the reader is referred to Bulletin 247 of the Agricultural Experiment Station, "Poultry Diseases, Their Prevention and Control."

Feeding small chicks on the same ground year after year may lead to heavy losses and to lowered vitality in those that survive, thus making them 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 onto the farm. Chickens brought to the farm should be kept in quarantine 10 days before turning them with the general flock and all exhibition and market coops should be thoroughly cleaned and disinfected before they are used or stored.

Diseases Which Can Be Controlled by Testing, Vaccinating, and Feeding.—Specific control measures have been developed

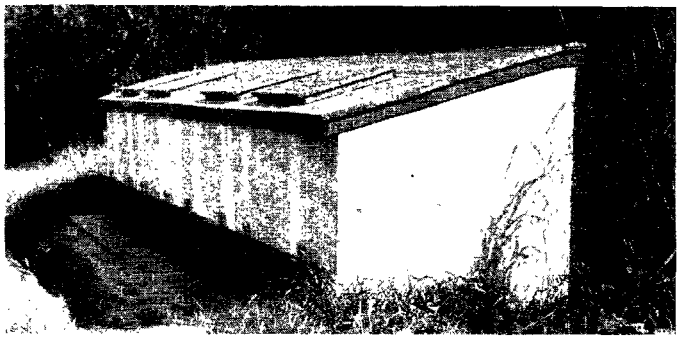

FIG. 26.—A concrete "vault" for storing poultry manure. This conserves the fertilizing value, prevents chickens scratching in the droppings, and helps control the propagation of flies.

for some poultry diseases and not for others. Those diseases caused by specific bacteria, viruses, or inadequate rations and for which definite control measures have been found are:

DISEASE	CONTROLLED BY
1. Pullorum (bacillary white diarrhea)	Culling, based upon agglutination test
2. Fowl pox	Vaccination
3. Infectious laryngotracheitis	Vaccination and hygiene
4. Avitaminosis	Feeding adequate diet

Pullorum disease can be controlled by making use of the tube serum agglutination test on the breeding stock for the detection of infected birds and by removing all reacting birds from the flock. Fowl pox, and laryngotracheitis can be prevented or controlled with some degree of success, by vaccination with virus, and avitaminosis is a nutritional deficiency disease which responds readily to the proper diet.

Diseases Which Depend Upon Sanitation and Management for Control.— Some of the common diseases for which specific control measures have not been found are: Roup, fowl paralysis, in-

fectious leukosis, fowl cholera, fowl typhoid, tuberculosis, and coccidiosis. Neither are drugs available, such as disinfectants, astringents, antiseptics, germicides, tonics, or other so-called remedies administered by feeding or injection, that can be depended upon to cure any of the above diseases once the birds become infected. Some antiseptics are of value when placed in the drinking water to check the spread of certain diseases through that medium, but beyond that they have little or no value. Poultrymen should also understand that it is useless to vaccinate with a specific or mixed bacterin in hope of controlling any of the above diseases for which remedies have not been found or when a definite diagnosis has not been made.

ERADICATION OF NONCURABLE DISEASES

The only satisfactory procedure to follow when one or more of the above diseases develop to serious proportions in the flock and persist year after year is to institute a general clean-up program. A method which has given satisfactory results is as follows:

Preliminary Cleaning.— Dispose of every adult bird on the place early in June. Remove and burn all litter from the floor and straw loft, nesting material, caked patches of dirt on the floor, and other accumulations of filth, taking care to avoid contamination of the ground adjacent to the buildings. All movable parts such as feed hoppers, nests, roosts, droppings boards, etc., should be removed, scraped, brushed, washed, disinfected, and permitted to dry in the sun. The interior of the house should be thoroughly swept, scrubbed, and sprayed with a 3 percent solution of some coal-tar disinfectant which dissolves readily in water. A pump with considerable pressure should be used. The same procedure should be used on all equipment occupied by adult birds such as broody coops, fattening batteries, shipping coops, and colony houses. After the spraying has been finished and the house permitted to dry a few hours, the equipment can be returned, the house closed tightly on all sides, and the doors nailed shut for the duration of the summer.

After the cleaning of the house is completed, the fences adjacent to the house are removed, all weeds and grass in the fence rows are pulled and removed or burned. The ground for 2 feet from the foundation on all sides of the house should be saturated with a disinfectant then turned with a spade. The yards and all additional ground around the house should be plowed 5 to 6 inches deep and summer fallowed by disking or harrowing every two weeks. This permits the sun to destroy the germs which live in the ground.

Final Cleaning.—Early in September the sweeping, cleaning, and disinfecting of the interior of the poultry house and all equipment should be repeated. New straw should be placed in the loft and on the floor and the yards should be sown with rye or winter wheat. Pullets reared on clean ground under quarantine or those purchased from a flock **known to be healthy** can be placed in the

house and given the best care and management. It is perhaps just as well to keep them confined until spring.

Every precaution should be exercised in introducing new stock and shipping coops onto the place. New stock is best introduced through hatching eggs since there is only one disease, pullorum disease (possibly paralysis, typhoid, and tuberculosis), which is transmitted through the egg. One should not permit neighbors or strangers to enter the laying house after going to all of the above expense to eradicate disease. When the above program is efficiently executed, there should be no further trouble from infectious diseases for several years.

APPENDIX

POULTRY IMPROVEMENT WORK

Poultry organizations in Kansas early conformed to the voluntary Uniform National Poultry Improvement Plan which became effective July 1, 1935. This plan provides for five breeding stages. These are designated as (1) U. S. Approved, (2) U. S. Verified, (3) U. S. Certified, (4) U. S. Record of Performance (fig. 27), and (5) Register of Merit. This program is under the supervision of the United States Department of Agriculture, Washington, D. C.; however, details as to the application of the plan are left to the various states. A brief statement regarding the requirements for each stage follows.

FIG. 27.—An important part of the poultry improvement work in Kansas is sponsored by the Record of Performance Association. In this picture (A) shows some of the members of this association with some members of the Kansas State College poultry staff. This work was organized in 1928. Some of the official poultry inspectors for Approved and Certified flocks and the instructional staff are shown in (B). Poultry-flock inspection work was begun in Kansas in 1922.

1. U. S. Approved. — Provision is made for (a) U. S. Approved flocks, (b) U. S. Approved eggs, (c) U. S. Approved chicks, and (d) U. S. Approved hatcheries.

U. S. Approved flocks shall consist of vigorous males and females, the latter being rigidly selected for egg production once a year. Standardbred and production qualities shall be required to a reasonably high degree. Males shall be from U. S. Approved flocks or better. All flocks shall be inspected by an official inspector at least once during the breeding season. All birds shall also be selected by an official inspector and sealed leg bands placed on those meeting the requirements. Birds rejected by the inspector shall have their tails clipped, leg bands removed, and shall be removed from the breeding flock not less than 20 days before any eggs for hatching are gathered. Only birds with official sealed and numbered leg bands shall be allowed in the breeding flocks. One variety only shall be kept on a farm unless where

more than one variety is kept, provision has been made to keep those varieties and their eggs separate.

U. S. Approved eggs shall come only from U. S. Approved flocks or of a better U. S. grade and shall weigh at least $1^{11}/_{12}$ ounces each.

U. S. Approved chicks shall be hatched only from U. S. Approved eggs or eggs of a better grade, and in U. S. Approved hatcheries.

U. S. Approved hatcheries shall be kept in strictly sanitary condition at all times, the incubators shall be thoroughly cleaned and disinfected after each hatch. Inspection will be made once during the season and the operator shall be required to keep records concerning number of eggs received from each flock, name and address of each purchaser, the number, breed, and variety, and date of shipment of all chicks.

2. U. S. Verified. — Provision is made for (a) U. S. Verified flocks, (b) U. S. Verified egg, (c) U. S. Verified chicks, and (d) U. S. Verified hatcheries.

U. S. Verified flocks shall meet all the requirements of the U. S. Approved flocks and shall be mated with males produced by flock matings of U. S. Record of Performance males and U. S. R. O. P. females. The chicks produced by such flock matings shall be wing banded at hatching time with official, sealed wing bands for later identification of cockerels. The birds shall be selected by an official state inspector, or by a selecting agent, once annually, and the flock shall be inspected by an official state inspector twice each year, one inspection of which shall be during the hatching season.

U. S. Verified eggs shall come only from U. S. Verified flocks or from flocks of a better U. S. grade and shall weigh at least $1^{11}/_{12}$ ounces each.

U. S. Verified chicks shall be hatched only from U. S. Verified eggs. The condition of sale and shipping as applied to U. S. Approved chicks shall also apply to U. S. Verified chicks.

U. S. Verified hatcheries shall hatch for sale U. S. Verified chicks only or U. S. R. O. P. chicks and shall fulfill all the requirements of U. S. Approved hatcheries, and shall be inspected by an official state inspector at least twice during the hatching season.

3. U. S. Certified. — Flocks, eggs, chicks, and hatcheries are provided for in this classification.

U. S. Certified flocks shall meet all the requirements of the U. S. Approved flocks and shall be mated to U. S. R. O. P. males out of U. S. R. O. P. females with yearly records of 200 or more eggs. The birds shall be selected by an official inspector once each year and two official inspections of the flock shall be made annually, one inspection shall be during the hatching season.

U. S. Certified eggs shall come only from Certified flocks and shall weigh at least 2 ounces each.

U. S. Certified chicks shall be hatched only from U. S. Certified eggs and in U. S. Certified hatcheries except that a hatchery may produce U. S. Certified chicks of one breed or variety and U. S. Approved of another breed or variety in which case the hatchery shall be recognized as a U. S. Approved hatchery.

U. S. Certified hatcheries shall hatch for sale U. S. Certified chicks only or U. S. R. O. P. chicks and shall fulfill all the requirements of U. S. Approved hatcheries, and shall be inspected by an official state inspector at least twice during the hatching season.

4. U. S. Record of Performance (R. 0. P.). — This breeding stage embraces records of egg production made on the breeder's premises under official supervision, and records of egg production made at officially conducted egg-laying contests, when such records are passed upon by the official state inspector or official state supervisor and when individual birds meet other R. O. P. requirements. Seven official inspections of one day each shall be made each year. The females shall be trap nested throughout the year in approved trap nests. The poultry plant shall be open at all times for unannounced visits of the official inspector. At such times, the inspector shall have sole charge of the trap nests and of eggs laid.

U. S. Record of Performance eggs, chicks, and breeding stock may be produced only on an R. O. P. breeder's premises.

U. S. R. O. P. pullets shall have laid 200 or more eggs during the first laying year which average 2 ounces or more each. A year is 365 days from the time of laying the first egg in a trap nest, provided that all first-year records shall end by November 30 except as otherwise provided for. Yearlings and older hens to qualify for R. O. P. shall have laid 200 or more eggs during the trap-nest year. The eggs shall attain an average weight of 25 ounces per dozen.

A U. S. R. O. P. breeding pen shall consist of U. S. R. O. P. females mated to U. S. R. O. P. males out of U. S. R. O. P. females with minimum records of 225 eggs and sired by an R. O. P. male. Other numerous details pertaining to this and the last stage may be had upon request to Kansas State College.

5. Register of Merit (R.O.M.). —This is the fifth and highest stage to date. The tentative plan as issued by the Bureau of Animal Industry, United States Department of Agriculture, is in part as follows:

A Register of Merit (R. O. M.) male shall be an R. O. P. male out of an R. O. P. or R. O. M. mating which, when mated to R. O. P. or R. O. M. females shall have at least one third of his daughters entered in R. O. P. qualify for R. O. P. with a minimum of 20 that qualify.

A Register of Merit female shall be an R. O. P. female out of an R. O. P. or R. O. M. mating, which when mated to an R. O. P. or R. O. M. male, has at least one third of her daughters entered in R. O. P. qualify for R. O. P. with a minimum of 4 that qualify.

The system also includes a "double star" (**) Register of Merit mating where an R. O. M. male shall be mated with R. O. M. females, and a single star (*) Register of Merit mating shall be one which consists of any one of five different combinations, as for example, R. O. M. male mated with R. O. P. daughters out of a double star R. O. M. mating; the reciprocal mating, etc.

Pullorum Eradication.—In addition to these five stages, provision shall be made for three stages of pullorum eradication as follows: (a) U. S. pullorum-tested flocks, hatchery, chicks, and eggs, (b) U. S. pullorum-passed flocks: hatchery, chicks, and eggs, and (c) U. S. pullorum-clean flocks, hatchery, chicks, and eggs.

In the first stage the flock shall be tested for pullorum disease (Bacillary white diarrhea) under official supervision once a year and ***all reactors removed.*** A pullorum-passed flock shall be one ***which contains no reactors*** upon official testing immediately preceding date of sale of hatching eggs. A pullorum-clean flock shall be one which ***contained no reactors in two consecutive tests*** not less than six months apart, the last test being made within the year immediately preceding date of sale of hatching eggs or breeding stock.

The Kansas Poultry Improvement Association consists of a general board of five directors who represent stages 1, 3, and 4 in the above groups and Kansas State College. This representative body has general supervision of poultry-improvement work in Kansas.

EDUCATIONAL PROGRAM FOR POULTRY ASSOCIATIONS

There are many local, county, and district or sectional poultry associations in Kansas, in addition io the stale associations. These associations and groups can accomplish much for their members by holding regular meetings and having an educational program as an important part of every gathering. The following plan is suggested to be used as a whole or in part as it best fits into the needs of the local group. The program is outlined for 12 monthly meetings. Groups meeting quarterly or semiannually could adopt any portion which might be appropriate for the occasion.

Organization of Groups. — The group should be divided into 12 committees and each committee made responsible for one educational program during the year. With a large membership this will not be difficult. With a limited number it may be necessary to ask some members to serve on more than one committee.

In appointing the committees, care should be used to select members who have specialized interests or who have achieved outstanding success in some phase of their work. Thus the best talent available can be used for each program. For example, a hatchery operator would probably be best qualified to discuss baby chicks, their care and management. A veterinarian who vaccinates poultry for pox, blood tests, or examines sick flocks or dead birds should be placed on a disease-program committee, etc.

Choosing Subjects and Assigning Committees. — Three subjects have been suggested for each month. One subject deals with production problems; one with feeding, management, or marketing; and one with an important disease or group of parasites. The topics are listed so as to usually precede by one month the actual application of the subject matter covered. The committee can confine its program to any one subject or it can attempt a discussion of all three subjects listed if that appears more desirable. References giving information on any of these subjects can be furnished upon request to the Department of Poultry Husbandry, Kansas State College, Manhattan.

OCTOBER

1. A renew of the American Standard of Perfection and the International Poultry Guide.
2. The inspection of farm and hatchery flocks.
3. Pullorum disease: symptoms, treatment, and control.

NOVEMBER

4. Breeding for exhibition purposes and egg production.
5. Complete rations for laying hens.
6. Fowl paralysis: symptoms, treatment, and control.

DECEMBER

7. The production and care of hatching eggs.
8. Methods of feeding breeding stock, layers, and growing chicks.
9. Prolapse of oviduct, vent gleet, and cannibalism.

JANUARY

10. Incubation, natural, artificial, and commercial hatching.
11. Confinement versus free-range for the laying and growing flocks.
12. Prevention rather than cure. What constitutes sanitation?

FEBRUARY

13. Brooding, natural and artificial.
14. Sexing baby chicks; chick rations.
15. Tuberculosis: symptoms, treatment, and control.

MARCH

16. Rearing the young stock.
17. Broiler production, breeds, methods, and markets.
18. Vaccination: value of, when and how practiced.

APRIL

19. Selection of breeding cockerels; capons and caponizing.
20. Clean ground, green feed, and range shelters for growing chicks.
21. Coccidiosis: symptoms, treatment, and control.

MAY

22. The economics of production and marketing.
23. Marketing eggs and selling on the graded basis. Suggest local produce man give a candling and grading demonstration.
24. External parasites: lice, mites, fleas, and chiggers.

JUNE

25. Culling: for past, present, and future production.
26. Egg auctions and cooperative shipping to market.
27. Internal parasites: round, tape, and pin worms.

JULY

28. Construction of poultry houses and interior equipment.
29. The history and origin of breeds and varieties of poultry.
30. Fowl pox: symptoms, treatment, and control.

AUGUST

31. Tour to leading poultry farms in community.
32. Artificial illumination of the laying flock.
33. Infectious laryngotracheitis, ruptured ova, and bumblefoot.

SEPTEMBER

34. Marketing poultry; killing, dressing, and drawing demonstration.
35. Fisting, training, and exhibiting poultry.
36. Colds and roup: symptoms, treatment, and control.

References and Suggestions for Preparing Programs. —References to books and bulletins giving information on each of the foregoing subjects are available. It would be advisable for each association to purchase the few books needed and write to the Kansas Agricultural Experiment Station, the agricultural experiment stations of other states, and the United States. Department of Agriculture for the appropriate bulletins. This material could then be passed from one committee to another as a circulating library for the preparation of programs. The references should be supplemented with other material and practical experience. There is very little written on some subjects as for example, "Clean ground for growing chicks," yet most poultrymen have experienced the benefits of this practice.

FARM POULTRY CALENDAR

The following are suggestions of some of the more important pieces of work to be done each month in caring for the farm flock. 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. A good flock should average 10 eggs per hen this month.
2. Keep birds confined in stormy weather.
3. Add 6 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 twenty-fifth 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 per hen.
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 (national holidays) to bring first hatch of any of the general-purpose breeds off in March.
5. Order material for shipping hatching eggs and baby chicks.
6. Supply green feed daily if it is not incorporated in mash.
7. Clean frozen droppings from under roosts the first day they thaw.
8. Attend the Poultry Short Course at K. S. C.
9. Examine the brooder and be sure it works.
10. Take a day off and visit your neighbor's flock.

MARCH

1. The flock average for this month should be 17 eggs per hen.
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.

APRIL

1. This is one of the months of highest production. Hens should average 18 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 needed.
5. Four hundred chicks should be 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. Paint all the roosts and supports with some coal-tar product such as carbolineum or creosote.
10. Write the Agricultural Experiment Station for literature and information on specific poultry problems.

MAY

1. This is the other month of highest production. Hens should average 19 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 when they weigh two pounds each.
7. The "early bird gets the worm," so open the houses at daylight.
8. Gather market eggs in basket twice daily remainder of summer. Place in cellar and allow to cool 24 hours before casing.
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 17 eggs each.
2. Sell or pen up all the adult male birds.
3. Remember that infertile eggs do not spoil so readily as fertile ones.
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 henhouse.
7. Keep on look out 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.

JULY

1. The July production should average 16 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 on wheat stubble 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 14 eggs a bird 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 12 eggs per hen.
2. The early pullets 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. Treat 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 improving.

OCTOBER

1. Production declines; a good average is 6 eggs per hen.
2. October 1 marks the start for most egg-laying contests.
3. The hens still laying are your highest producers.
4. Select the best laying hens to be kept as breeders.
5. Last chance to get your application in for flock-improvement work.
6. Don't overcrowd the houses—remember 3½ to 4 square feet per bird
7. Each hen needs 7 to 9 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 one of the low months of the year for egg production, but the average should be 7 eggs per hen.
2. Artificial illumination, if used on pullets, should start November 1.
3. Round up the largest capons to fatten for Thanksgiving.
4. For breeding purposes, the male is half the flock.
5. Choose vigorous, stout males of good color and type for mating.
6. Eggs are high in price because they are scarce.
7. Regularity in care and management is one of the secrets of success.
8. Reserve the best capon for your own Thanksgiving dinner.
9. Interest your city friends in capons for the holidays.
10. Kill, dress, and draw market birds and relieve the consumer of this drudgery.

DECEMBER

1. The year should close with an average of 9 eggs for the month and a total of 156 for the year from each hen and pullet.
2. This monthly production is a good average for a mixed flock of hens and pullets.
3. Close the front curtains during 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