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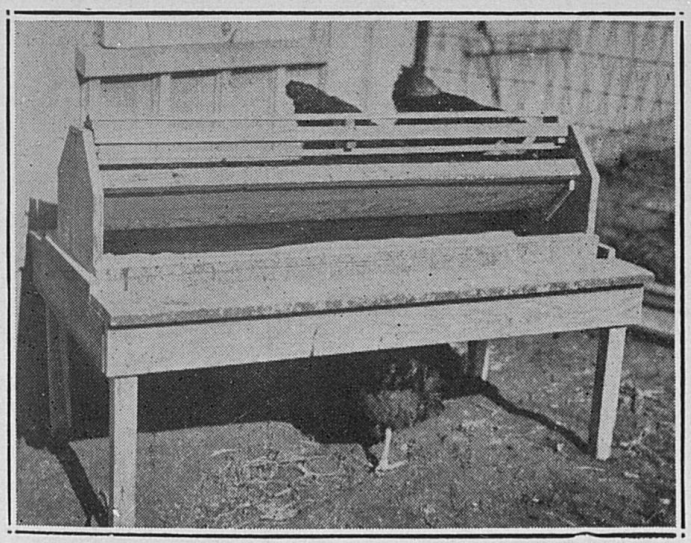
CIRCULAR NO. 287
(Revised)

FEEDING AND MANAGEMENT OF LAYING HENS



Details of this double-deck hopper are on page 20.

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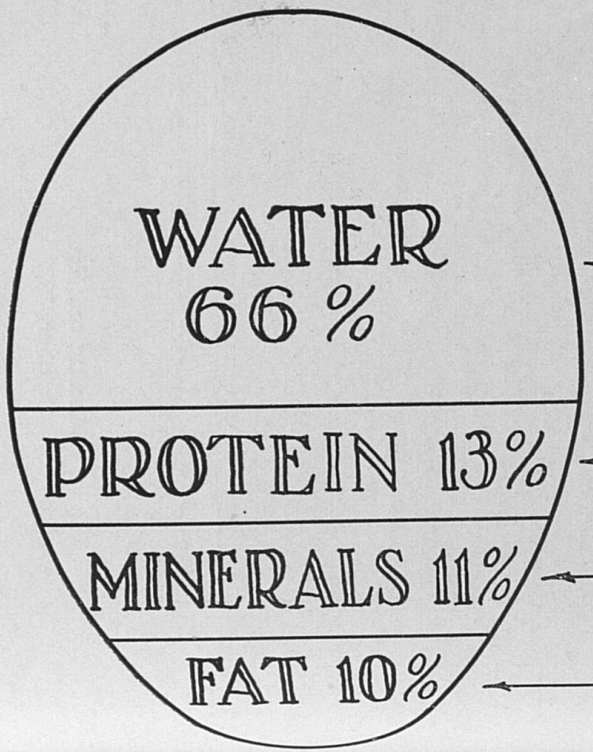
Composition of Egg



Sources in Feed

- WATER: Drinking Water, Liquid Milk, Succulent Green Feed
- PROTEIN 13%: Milk, Meat Scrap, Fish Meal, Soybean Oil Meal
- MINERALS 11%: Limestone, Oyster Shell, Bone Meal, Salt
- FAT 10%: Corn, Wheat, Barley, Oats, Grain By-Products

Circular No. 287
(Revised)

FEEDING AND MANAGEMENT OF LAYING HENS

By STANLEY CATON, W. M. INSKO, JR., and A. T. RINGROSE

A satisfactory income from the poultry flock depends upon it producing eggs not only in the spring but in all seasons of the year. In order to assure high egg production during the late summer, fall and winter it is absolutely necessary that hens be fed and managed properly.

Feed consumed by the laying hen has a two-fold function; it must first take care of body up-keep and, secondly, supply the materials for egg production. A feed or a combination of feeds may not be the means of effecting high egg production unless it is balanced, or complete, for that particular purpose. Abundance of green feed, sunshine and relatively mild winter weather aid greatly in promoting egg production, but these conditions must be supplemented with proper feed. Each constituent of the egg must be supplied in adequate quantity for maximum egg production. The proportions of the constituents of the egg are indicated in the diagram on the opposite page.

PROTEIN

An insufficient quantity of protein in the feed of laying hens, is the major limiting factor in feeding for egg production. Two kinds of protein are used in laying mash, one from animal sources and the other from plant sources. Animal protein is much superior to plant protein in laying-mash mixtures.

Animal Protein. Meat scrap.* This by-product of the meat-packing industry should be used as the major protein concentrate in laying mash, in Kentucky, and should make up 20 percent of the dry mash, by weight, when used as the only protein concentrate. Meat scrap also is rich in the bone-building minerals, calcium and phosphorus, and is readily available, palatable and produces good results. When meat scrap is the source of protein in the laying

* "Meat scrap is the ground, dry-rendered residue from animal tissues exclusive of hoof, horn, manure and stomach contents, except in such traces as might occur unavoidably in good factory practice. When this product contains more than 10 percent of phosphoric acid (expressed as P_2O_5), it shall be designated Meat and Bone Scrap."

mash, egg production increases as the proportion of meat scrap in the mash increases; however, there is no advantage in exceeding 20 pounds of meat scrap in each 100 pounds of mash. The approximate protein content of meat scrap is 50 to 60 percent.

Milk in all forms is an excellent source of protein for laying hens. Dried or condensed milk is not liberally used by Kentucky poultrymen because of its comparatively high cost, altho at certain seasons of the year, especially just previous to and during the hatching season, the addition of milk in some form to the poultry diet is an excellent practice because it increases the hatchability of the eggs.

On many farms skim milk is not available in sufficient amount to be used as the sole source of animal protein. When there is likelihood of a shortage of milk it is well to have accessible, continuously, in a self-feeder, a dry mash containing 5 percent of meat scrap. In event of a shortage of milk, the proportion of meat scrap in the mash should be increased. When as many as four gallons of milk are available daily for 100 hens, 5 percent of meat scrap in the mash is sufficient. When only two gallons are available daily for each 100 hens, the meat scrap should be increased to 10 percent of the mash. If the supply of milk should be cut off, the proportion of meat scrap in the mash should be increased to 20 percent.

Feeding trials at the Kentucky Experiment Station show that when the flock is fed all the milk it will consume, profitable egg production results, even if nothing else but grain and limestone is fed.

Liquid skim milk and buttermilk attract flies, the intermediate host of the tapeworm, unless particular care is taken to keep the feeding utensils clean. In hot weather it is advisable to put the milk before the flock by 6 a. m., and leave it there until about 10 a. m. In the middle of the morning the unconsumed milk should be removed and the pans cleaned thoroly. During the rest of the day water should be accessible. When milk is not fed thruout the day, the mash should contain more meat scrap.

Dried milk does not attract flies and may be mixed in the laying mash. One pound of dried milk is equivalent to about three pounds of condensed buttermilk, or nine pounds of liquid skim milk. The dry-matter content should be considered in determining which form of milk is to be fed, if the milk must be purchased.

Vegetable Protein. The common sources of vegetable protein in poultry feeds are soybean oil meal, corn gluten meal, linseed oil meal and peanut meal. Because vegetable protein concentrates are low in the mineral elements, calcium and phosphorus, the mash should be supplemented with steamed bone meal which contains these elements.

Soybean oil meal can be used successfully to replace a portion of the meat scrap in laying-mash mixtures and its use is becoming more prevalent. It may replace one-fourth to one-half of the meat scrap. One pound of steamed bone meal should be added for each 5 or 6 pounds of soybean oil meal.

Since linseed oil meal has a laxative effect, it should not exceed 5 percent of the mash.

In cleaning lespedeza seed a mixture of low-grade seed and weed seed containing about 28 percent of protein is left as a by-product. If ground to destroy the weed seed, this material may be added to the laying mash to replace one-fourth of the meat scrap. Since it is a vegetable source of protein, one pound of steamed bone meal should be mixed with each five pounds of ground lespedeza seed.

Cottonseed meal, if fed in large quantities, reduces hatchability and lowers the keeping quality of eggs. It frequently causes the egg yolk to become mottled or spotted in appearance after the eggs have been kept in storage for four weeks or more. A safe plan to follow, if cottonseed meal is used, is to limit the quantity to 5 percent by weight of the mash mixture and to use one pound of steamed bone meal for each 5 pounds of cotton-seed meal.

DISTILLERY BY-PRODUCTS

The distillery by-products used in feeding livestock are thick slop, thin slop and distillers' dried grains. The dried grains are on the market as a commercial feed; the first two are obtainable by farmers near a distillery. They are derived mainly from corn and rye, a fact which should be taken into account when feeding them to any kind of livestock. The processes of mashing and fermentation change most of the starch of the grain into alcohol but leave the protein, fat, fiber and mineral matter practically unchanged; hence the slop and the dried grains are high-protein feeds. Little experimental work has been done in the use of these materials for

feeding laying hens, so recommendations as to their use for this purpose are based on general considerations.

Thick slop is the soup-like liquid which remains after the alcohol has been distilled from the fermented mash, in the manufacture of whisky from grain. It contains about 7 percent of solid matter. This percentage can be increased by permitting it to settle and drawing or dipping off the clear liquid from the top.

Thin slop is the liquid which runs thru the filters when the coarser particles are filtered out of thick slop for making distillers' dried grains. Tho thin slop has been fed successfully to cattle it is not highly valued as a poultry feed because of the low solids content and the high water content. Thin slop usually contains less than 5 percent solids.

Thick slop has been used successfully as a poultry feed to replace as much as one-half of the ground yellow corn in the laying mash. Except where all-mash feeding is practiced, the grain and dry mash should be placed in separate feeders and kept before the flock at all times. The thick slop may be fed in a separate trough or as a wet mash, at noon, by mixing it with an equal amount of the dry mash.

Strict sanitation is essential when slop is fed to chickens. The pans should be washed thoroly at least once a day. Care should be taken not to spill the slop in the laying house, as it may stay there unnoticed and mold or sour. Spoiled slop, if eaten, may endanger the health of the flock. In warm weather flies are attracted by the slop which often results in an infestation of tapeworms in poultry, since flies are the intermediate host of the tapeworm. Frequent cleaning and sunning of the trough in which the slop is fed lessens the trouble from disease and parasites.

Some factors to consider regarding the economy of feeding slop are cost of slop, thickness of slop, whether it is wholly or partially strained, facilities for keeping slop to prevent it from molding or becoming too sour and whether the feeder is willing to practice strict cleanliness in feeding. The effect, if any, of distillery by-products on the interior quality of eggs or on hatchability has not been determined.

Distillers' Dried Grains consist of the solid particles filtered out of the slop and dried. The guaranteed chemical analysis is stated on the official tag. Usually it is about 28 to 30 percent of protein, 11 of fat and 10 of fiber. The value of distillers' dried grains in a

laying mash has not been determined definitely enough to warrant a recommendation as to its use; however, the quantity of fiber present indicates that it may be used to replace only a small quantity of the other protein carrying materials.

COMMERCIAL PROTEIN SUPPLEMENTS

In some cases it is difficult for the poultry raiser to obtain the ingredients to prepare a mash mixture at home. There are on the market protein supplements which can be readily combined with home-grown grain to make a good laying mash. The supplements contain 30 to 32 percent of protein and usually are made up of such materials as soybean oil meal, linseed oil meal, corn gluten meal, meat scrap, dried milk, fish meal, wheat bran, wheat shorts, alfalfa leaf meal, cod liver oil, salt and ground limestone. In addition to being a source of protein, certain essential vitamins and minerals are provided. Some ground corn, ground oats and oat groats are usually added to them by the manufacturer.

In buying such materials the poultry raiser should consider the ingredients as stated on the official tag and the final cost of preparing a laying mash from them. These feeds are usually made of high-grade materials, for adulterations are readily recognizable.

Two methods of using the protein supplements are suggested. Some poultrymen have had good results from feeding the protein supplement in one hopper and grain in another. Particular care must be taken to be certain that grain is available at all times when this system of feeding is used. Another method is to mix the protein supplement with sufficient ground yellow corn or other grains to make a mash mixture which contains 18 to 20 percent of protein. This mash should be fed in the same manner as recommended for other mashes suggested in this circular.

GRAINS

Grains furnish much of the fat of the egg and also much of the energy- and heat-giving parts of the hen's ration. It is the grain that enables a hen to maintain body weight. Feeding a large quantity of grain to prevent fall molt is based on the principle of maintenance of body flesh.

Corn is the principal grain in practically all poultry feeds used in the middle western states. Undoubtedly it is the most satisfactory

grain because it is relatively cheap, abundant, highly digestible and is relished by chickens. It should constitute the greater part of the grain used in both the scratch grain and mash. Yellow corn is preferable to white because the yellow is rich in vitamin A, deficiency of which causes certain nutritional disorders. Corn used as the grain feed or as a part of the grain mixture need not be cracked; whole corn is eaten readily by the hens and is fed with little waste.

When purchasing ground corn for mash mixtures one should be certain that it is made from the whole kernels. The germ is sometimes removed from corn in milling. The resulting cornmeal is not so good for poultry feed, inasmuch as the germ, which has been removed, is rich in vitamins B and E.

Wheat is considered one of the best grains for poultry feed and, if it can be had at a price per bushel not more than 10 cents above that of corn, may be used to replace part of the corn in the poultry ration. Whole wheat may be used in the grain mixture or it may be ground and used in the mash mixture, to replace part of the corn. Wheat does not contain vitamin A. The absence of this vitamin causes nutritional roup in poultry. When wheat or white corn is used instead of yellow corn, in the poultry ration, green feed or alfalfa or clover hay should be supplied at all times.

Barley is relished by fowls and is a very desirable grain to add to the mixture, when not too high priced. It may compose one-tenth to one-third of the grain mixture.

Rye is unpalatable and tends to cause sticky droppings. It should never be used in the grain mixture but may be ground and used in the dry mash to replace not more than 5 percent of the wheat mixed feed. The green rye plant is highly palatable and an excellent source of succulence for the laying flock.

Oats, if heavy (over 32 lbs. per bushel), may be used to the extent of one-fourth of the grain mixture. Light oats contain much fiber and are not highly palatable; hence, if fed, it is best to grind them for the mash, or sprout them for use as succulent feed.

MINERALS

The mineral content of the egg is about 11 percent of the total weight. The greater part of the mineral is the calcium carbonate which composes the shell. Of course there are many different minerals in the egg but calcium and phosphorus are two important

elements.* Calcium is supplied in sufficient quantity to the laying hens if oyster shell or limestone chips (1/4 inch) are kept before the flock constantly. Kentucky limestone, except that which contains more than 5 percent of magnesium carbonate, is a good source of calcium for laying hens, provided most of the particles are from the size of wheat grains to the size of shelled corn. Phosphorus is supplied in sufficient quantity in the ground bone present in meat scrap, if this is the source of protein in the laying mash. A vegetable protein source, such as soybean meal, is deficient in mineral and should be supplemented with bone meal to make up the deficiency.

The mash mixtures suggested in this circular contain sufficient minerals, except calcium which is amply provided by the oyster shell or limestone always kept before the flock. Complex mineral mixtures, such as those widely advertised, are not necessary if the formulas given in this circular are used.

Grit. Pullets raised on range pick up enough grit to last them thru the laying year. In order to serve permanently in the gizzard for grinding, grit must be hard and insoluble in digestive juices. Creek-bed gravel serves quite as well as quartz or mica grit, and often can be had at no cost. Experiments show that grit is not essential for growth and egg production.

Limestone, Calcite and Oyster Shell are readily soluble in the digestive tract of the fowl and last only a short time for grinding feed in the gizzard; hence, they are not grit, as they are soon broken down chemically, and the calcium is utilized in the formation of eggshell. Egg production is greatly restricted if calcium carbonate in some readily available form such as limestone or oyster shell is not present.

Manganese in the ration in sufficient quantity is necessary for high egg production, thick eggshell, and high hatchability. If the feed is deficient in manganese, there is an increased mortality in the developing embryos and the chicks produced may have very short legs, parrot beak and retracted head. This condition may be prevented by the inclusion of at least 50 percent of wheat middlings or mixed wheat feed in the mash or the addition of four ounces of manganese sulfate to each ton of mash. When green range is available the hens will get sufficient manganese to prevent these abnormalities.

* The egg yolk is relatively rich in iron and copper.

Vitamins and their importance.

Vitamins	Deficiency causes	Function	Principal sources
A	Nutritional roup (xeropthalmia) Low egg production Low hatchability Stunted growth High mortality	Essential for normal reproduction Promotes growth	Fish liver oil Legume hay or meal Pasture Yellow corn
B	Poor growth Loss of appetite Spastic head retractions High mortality	Promotes growth Prevents (polyneuritis) nervous disorder	Liquid or dried milk Wheat germ Wheat bran Pasture
D	Rickets (soft or weak bones) Slower growth	Proper bone growth Essential for normal embryonic development	Fish liver oil Direct sunshine (not thru window glass)
E	Sterility in males Failure in hatchability	Normal fertility Normal hatchability	Wheat germ oil Whole grains (grain germ) Pasture
G Ribo-flavin	Stunted growth Decreased egg production Decreased hatchability	Promotes growth Necessary for normal embryonic development	Yeast Liquid or dried milk Legume meal hay Pasture
G Antipel-lagric	Growth failure Pellagra (sores at corners of mouth, eye and bottoms of feet)	Promotes growth Necessary for hatchability	Liver meal Liquid or dried milk Yeast Cane molasses Pasture

* All vitamins are necessary for poultry except vitamin C, but the ones most apt to be deficient are vitamins A, D and G.

WATER

Since the egg is nearly two-thirds water, water is an essential part of the poultry ration tho often a neglected part. Egg production will be lessened unless the hens are supplied at all times with fresh, clean water, or are given all the milk they will drink. The water pans or utensils should be kept clean by frequent scrubbing, for disease may be spread thru filthy drinking water. Fresh, cool water should be put before the flock frequently in hot weather and the water containers should be in a shady place. In the winter the water should be warmed. The poultry flock should not drink stagnant water from small pools or ponds because of the danger of spread of disease.

SUCCULENT FEED

Green feed is desirable for the laying flock because it supplies certain essential food factors known as vitamins, as well as some important mineral elements. If *white* corn is used in the grain mixture and commercial corn meal (without the germs) in the mash, green feed is practically a necessity. If *yellow* corn is used as grain and ground yellow corn (germ as well as starchy portion) in the mash, green feed is not so essential in feeding laying hens. However, green feed deepens the yellow color of the egg yolk. It is well known that green feed is essential for the breeding hens, as its use increases the hatchability of the eggs.

In Kentucky, a good clover or alfalfa pasture, supplemented by a patch of green rye, will provide the flock with ample succulent feed thruout most of the year. If, in addition to the pasture, the flock is given access to alfalfa, clover, or korean lespedeza hay, especially when the weather is such that the flock remains close to or in the house, the green feed requirements of the flock will be met.

Sprouted oats, cabbage, and beets are sources of succulence for the laying flock. Mangel beets and sugar beets, tho succulent, do not supply the vitamin factors found in green feed and hence are not particularly advantageous.

PASTURE

If the poultry flock is allowed range, the hens should be able to find green feed some place about the farm thruout the year, except for a few weeks in mid-winter. Some farmers prefer to fence the poultry flock and rotate the yards or pasture fields. This is a satis-

Pasture

* All vitamins are necessary for poultry except vitamin C, but the ones most apt to be deficient are vitamins A, D and G.

factory practice which not only assures green feed thruout most of the year but also aids in the control of soil-borne diseases and parasites, principal among which are coccidiosis and intestinal worms. For a system of yarding, the poultry house should be in the center of a field divided into three or four equal areas. The flock is to be kept a year in each yard, in rotation. The yards or areas not occupied by the chickens may be used as pasture for other livestock or cultivated in a suitable rotation.

Bluegrass is the best sod for such a range, especially if it contains some white clover. Another sod satisfactory for pasturing poultry the year round, may be obtained by sowing a mixture of orchard grass, 10 pounds; redtop, 5 pounds; sweet clover, 5 pounds; Korean lespedeza, 5 pounds; and Japan clover, 3 pounds. This amount, 28 pounds, is sufficient to seed one acre. The following schedule may be followed to maintain a clean range:

1st Year - - Poultry range
2nd Year - - Corn or tobacco or garden
3rd Year - - Small grain followed by grass
4th Year - - Meadow (calf pasture)
5th Year - - Repeat the schedule

DESIRABLE GRAINS

Any of the following grains or grain mixtures will be found satisfactory. In determining which grain or combination of grains to use, cost, quality, and availability should be considered.

		Pounds	Quarts
1.	Shelled yellow corn	100	60
2.	Corn	50	30
	Wheat	50	26
3.	Corn	70	42
	Oats (heavy)	30	30
4.	Corn	50	30
	Wheat	25	13
	Oats (heavy)	25	25
5.	Corn	40	24
	Barley	20	13½
	Wheat	20	10½
	Oats (heavy)	20	20

DRY MASH MIXTURES

1.	Wheat mixed feed	300
	Ground corn	100
	Meat scrap	100
	Salt	5
	Fish liver oil*	
2.	Wheat mixed feed	200
	Ground corn	200
	Meat scrap	100
	Salt	5
	Fish liver oil*	
3.	Wheat bran	100
	Wheat middlings or shorts	100
	Ground corn	100
	Ground oats	100
	Meat scrap	100
	Salt	5
	Fish liver oil*	
4.	Ground yellow corn	500
	Wheat bran	500
	Wheat middlings or shorts	500
	Meat scrap	300
	Dried buttermilk or skim milk	100
	Alfalfa leaf meal	100
	Salt	20
	Fish liver oil*	
5.	Ground yellow corn	500
	Wheat bran	500
	Wheat middlings or shorts	500
	Meat scrap	200
	Soybean oil meal	100
	Dried buttermilk or skim milk	100
	Alfalfa leaf meal	100
	Steamed bone meal	20
	Salt	20
	Fish liver oil*	
6.	Ground yellow corn	460
	Wheat bran	400
	Wheat middlings or shorts	500
	Meat scrap	140
	Soybean oil meal	140
	Dried buttermilk or skim milk	200
	Alfalfa leaf meal	100
	Steamed bone meal	40
	Salt	20
	Fish liver oil*	

* See page 14.

Any one of the dry mash mixtures may be fed along with shelled corn or any of the grain mixtures suggested.

These mashes have one thing in common, namely, each contains animal protein, either in the form of meat scrap or milk. Feeding trials have shown that unless there is some form of animal protein in the mash, little or no advantage is gained by using a mash mixture.

Mixtures Nos. 1, 2 and 3 should be used when hens have some range and green feed. Wheat mixed feed may be substituted for the bran and shorts in any mixture. The ground corn should consist of the entire grain not too finely ground. Mixtures Nos. 4, 5 and 6 should be used when hens are kept in confinement or semi-confinement. The formulas are given for ton lots, since many local millers are glad to mix open-formula feeds when they are wanted by a number of poultrymen in the community. The alfalfa leaf meal largely replaces green feed which hens on range can get.

In preparing these mash mixtures care should be taken (1) to select high-grade materials, (2) to use ingredients in correct proportions, (3) to mix ingredients thoroly.* All lumps of salt should be broken. Cod liver oil should be mixed with a small portion of the ground corn when it is to be mixed in the mash and then this ground corn and cod liver oil thoroly mixed with the rest of the ingredients. If the grain is to be fed in hoppers or V-shaped troughs, the cod liver oil may be mixed with the grain.

FISH LIVER OIL

The use of cod liver oil or other fish liver oil is recommended when hens are confined during the winter and for at least a month before the time that eggs are to be saved for hatching and during the entire hatching season. The value of cod liver oil or other fish oil for poultry feeding is dependent upon its vitamin D content. The vitamin D content is expressed in terms of A.O.A.C. chick units** of vitamin D per gram of oil, which means that the potency of the oil has been determined by definite feeding tests with chickens. All cod liver oil or fish liver oil for poultry feeding should be purchased on the basis of its A.O.A.C. chick unit guaranty. The vitamin D oils most generally available contain 85 to 100 A.O.A.C.

* If no feed mixer is available the ingredients may be spread on a clean floor and shovelled back and forth 5 or 6 times as in mixing concrete.

** Unit defined by the Association of Official Agricultural Chemists.

chick units per gram and vitamin D oil concentrates contain 400 A.O.A.C. chick units per gram. The following schedule should be used as a guide when incorporating cod liver or other fish oil into the ration as a vitamin D supplement.

Percent of oil to be added to the mash in winter.

When feeding	A.O.A.C. Chick units per gram of oil	Hens confined	Partial confinement
All-mash	85-100	1	½
	400	¼	⅛
Grain and mash	85-100	2	1
	400	½	¼

Whenever the birds are kept in confinement during other periods of the year this schedule for winter feeding should be followed.

ALL-MASH MIXTURES

Some poultry flock owners prefer feeding an all-mash mixture. This is merely a mixture in which all the grain that is to be fed is ground and mixed in the mash. Any of the mash mixtures given in this circular may be converted readily to all-mash mixtures by adding an equal amount of ground corn to the mash. As good production can be had by the "all-mash" method of feeding, as by feeding the grain separately.

The advantages claimed for the all-mash are that it is a clean way to feed and it gives the feeder an opportunity to control the proportion of ingredients consumed by each bird. The disadvantages are that it is more costly, since more grain must be ground, and that the flock might not be watched quite so closely, since the poultryman does not go to the laying house so frequently as when grain is fed twice daily.

METHODS OF FEEDING

There are several different methods of feeding which may be followed with equally good results. Laying mash should always be self-fed; that is, it should be kept before the hens at all times, in hoppers or self-feeders. The type of hopper illustrated on the title page of this circular is in general use in Kentucky. It is of vital importance that enough hopper space be allowed so that the more timid hens may not be crowded away from the feed. At least three

mash hoppers four feet long and so constructed that the hens can eat from both sides should be provided for a flock of 100. This allows a total of 24 feet of feeding space, or approximately one foot for each four hens. If an all-mash mixture is used, additional space must be provided, since all the feed consumed must come from the mash hoppers.

FIGURE 1. Ample hopper space should be provided the laying flock.

Never allow the mash hoppers to become empty and do not fill them so full that the hens can "bill" the feed out on the floor. If the hoppers are filled from one-half to three-fourths full and fresh feed is added at frequent intervals the hens will consume the mash more readily and less will be wasted. Never pass thru the poultry house without stirring the mash that is in the hoppers.

Grain may be fed in one of three ways, any one of which will prove successful. The usual way is to scatter the grain in the litter and let the hens scratch for it, feeding them as much grain as the flock owner's judgment suggests. Some poultrymen limit the amount of grain and, instead of feeding it in the litter, put it into long, V-shaped troughs, twice a day, more at night than in the morning.

The only difference between these two methods is that according to the one, grain is fed in the litter and according to the other, a trough is used; by both methods the discretion of the flock owner governs the amount of grain to be fed.

A third method is to place the grain in hoppers and allow the hens to eat as much as they want. This has proved satisfactory under practical conditions and many flock owners use it. When grain is self-fed, two additional hoppers four feet long must be provided for each 100 hens. The results of feeding trials comparing self-fed grain with litter-fed grain at the Kentucky Experiment Station are given in the following table:

Average Egg Production Per Hen, and Pounds of Feed Per Dozen Eggs

Lot	White Leghorn 1930-31	Barred Plymouth Rock 1930-31	Barred Plymouth Rock 1931-32	Rhode Island Red 1931-32	General average
Winter egg production					
Litter-fed grain	75	83	71	61	73
Hopper-fed grain	75	76	72	61	71
Year's egg production					
Litter-fed grain	189	191*	181	162	181
Hopper-fed grain	192	184*	169	165	178
			75 Rocks and 25 Reds in each pen		
Grain (lbs.) per dozen eggs					
Litter-fed pen	3.05	3.34	3.66		3.35
Hopper-fed pen	3.32	3.97	4.80		4.03
Mash (lbs.) per dozen eggs					
Litter-fed pen	1.91	2.07	2.25		2.08
Hopper-fed pen	1.66	1.91	1.57		1.71
Total (lbs.) grain and mash**					
Litter-fed pen	4.96	5.41	5.91		5.43
Hopper-fed pen	4.98	5.88	6.37		5.74

* For eleven months.

** In this experiment it took approximately 5 lbs. of feed for Leghorns per dozen eggs and 6 lbs. for Rocks and Reds. If the egg production had been lower the feed requirement per dozen eggs would have been increased.

If the flock owner wants the hens to scratch in the litter when hoppers or troughs are used to self-feed grain, a small amount of grain, preferably wheat, should be scattered in the litter.

Alfalfa, Korean lespedeza or clover hay may be fed from wire racks. If sprouted grain, cabbage or other succulent feed is used it should be fed in a manner which prevents its becoming dirty.

Unless milk is fed, water must be kept before the hens at all times. A four-foot metal hog trough that fits on a table similar to the one used for supporting the mash hopper makes a good water

vessel. Place it high enough from the floor so that litter does not get into the water.

If hens are to maintain a high winter rate of production it is generally conceded that they must maintain good body weight. To do this, hens must consume a greater quantity of grain in the fall and winter than in the summer. It is a good plan to handle the hens occasionally during the winter and if they are getting thin, more grain should be fed. Let the condition of the flock govern the feeding practice. Do not make any radical change in feeds or management; either one may cause an interruption of egg production. Loss of appetite indicates something is wrong that should be corrected.

FEED CONSUMPTION

The amount of feed consumed per year by a hen depends on the breed, the amount of range available, and the number of eggs she lays. Light breeds such as the Leghorn, consume approximately 75 pounds total of grain and mash per year, whereas the general-purpose breeds such as the Rhode Island Red and Plymouth Rock consume 10 to 12 pounds more per bird annually. The approximate daily feed consumption per 100 birds, at this rate, for Leghorns, is 20 pounds and for Rocks and Reds, 23 to 25 pounds. Thus it may be seen that the feed requirement of a flock may easily be calculated by allowing 1/5 pound of feed per day for Leghorns and 1/4 pound for general-purpose breeds.

MOIST MASH

A moist mash, made by moistening some of the dry mash with either warm water or milk, may be fed to the hens at noon. Moist mash is especially beneficial to hens in the fall and winter. It is most palatable to them and the more feed they consume the better they maintain body weight. The mash should be made crumbly moist, never so wet as to be sloppy. Moisten about three pounds of the dry mash for each one hundred hens. A moist mash often stimulates pullets into production and is useful for pullets or breeders which are slow about starting to lay.

Moist mash may be fed in V-shaped troughs or on top of the dry mash but care should be taken not to feed more than the hens will clean up in about fifteen minutes. Plenty of trough room should be

allowed so that all the hens can get to the moist mash without crowding some of the timid ones away.

ARTIFICIAL LIGHT

The use of artificial light for the flock of laying pullets has become a rather common practice among commercial poultrymen in Kentucky. Its use lengthens the hen's working day, thereby approaching spring conditions and stimulating increased winter production. If electricity is available, two 40-watt bulbs should be used for each 20′ x 20′ pen and they should be turned on at 4 a. m.* The lights may be left on all night with satisfactory results if two 15-watt bulbs are used in each 20′ x 20′ pen. A feed hopper should be placed under each light. If electricity is not available and a lantern is used, care should be taken to protect the roof immediately above it, with sheet metal or asbestos. Little good is accomplished by lengthening the day unless balanced feeds such as those suggested in this circular are fed.

Three years' experimental work with artificial light, at the Kentucky Experiment Station, shows that while lights may not increase the annual production of the pullets, their use shifts the distribution of production by increasing the egg production during the winter. If artificial light is used in Kentucky it is advisable to begin between October 15 and November 1 and continue its use to the middle of March. Artificial light should not be used on breeding stock until about the first of January.

FEEDING BROODY HENS

It is bad practice to starve broody hens as a means of breaking them from setting. The sooner a broody hen goes back into laying condition, the more quickly will the broody spell be broken. Consequently, broody hens should be fed the same ration as the laying hens and given all the mash they care to eat. It is even advisable to feed them moist mash once or twice daily. If broody hens are not fed a laying ration while being broken up, they take several days longer to get back into laying condition. If it is desired to eliminate broodiness from the flock, do not return the broody hens to the flock after they have been broken up, but fatten and market them.

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* Information on the installation of lights will be found in Kentucky Extension Circular 107, "Housing Farm Poultry."

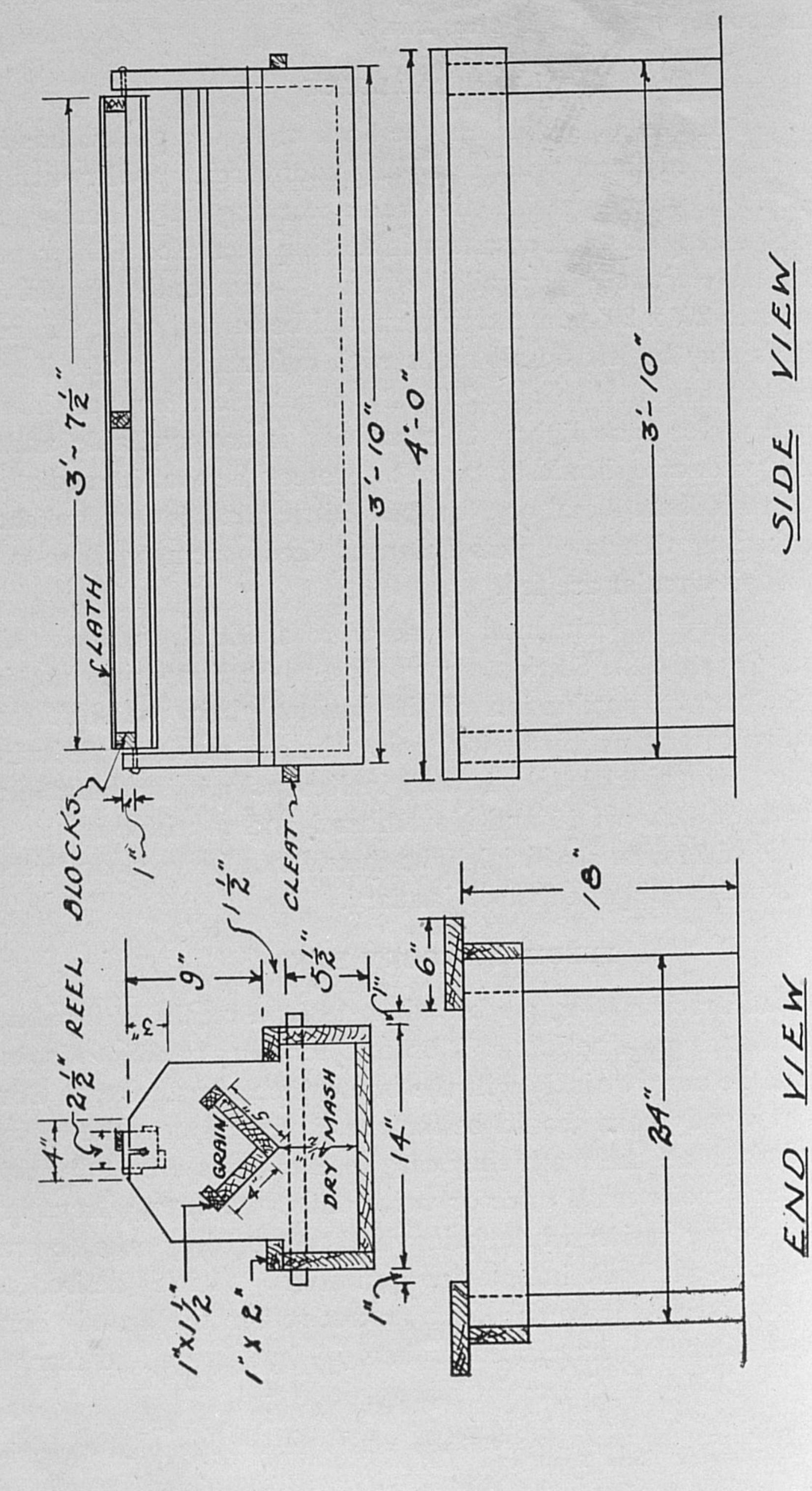

FIGURE 2. Details of double-deck hopper pictured on the title page.

PURCHASING THE FEED SUPPLIES

Often it is advisable to purchase feed materials such as meat scrap or mill feeds in large quantities and at certain seasons of the year while they can be bought more cheaply. It pays to study the fluctuations of the market and to know the price of materials from various firms, for often a saving in the purchase of a year's feed supply may be as much as the return from a considerable increase in egg production.

SUGGESTIONS

A balanced feed is one of the four factors essential to high egg production. The other factors are (1) hens bred for high egg production, (2) well-developed, vigorous, healthy hens, and (3) a comfortable house with plenty of room. Correct feeding alone cannot give maximum egg production.

Water pans should be kept clean and filled with pure, fresh water. Supply cool water in the summer and warm water in the winter.

No formula or mixture of feeds will meet all conditions. Cost and availability of the feed ingredients should be considered when selecting a formula for feed.

Self-feeders or hoppers for grain as well as for mash permit the balancing of the ration by the hens and keep the feed clean. Hopper-feeding of grain can be practiced with any breed. However, if the hens get too fat or drop off in production, grain consumption may be limited by hand feeding it in the litter for a few weeks.

FIGURE 2. Details of double-deck hopper pictured on the title page.

Average Composition of Common Feedstuffs for Poultry

Kinds of feeds	Pounds in 100 pounds				
	Protein	Fat	Fiber	Water	Ash
Feeds of Vegetable Origin					
Alfalfa leaf meal	20.0	3.0	16.0	6.5	12.0
Alfalfa meal	14.0	2.0	30.0	9.0	9.0
Barley	11.5	2.0	5.0	9.0	2.7
Buckwheat	10.5	2.5	10.5	12.0	2.0
Corn	9.5	4.0	2.0	11.0	1.5
Corn bran	10.0	6.0	10.0	10.0	2.3
Corn feed meal	8.5	4.0	4.5	11.0	1.5
Corn gluten feed	25.0	2.7	7.0	9.5	6.0
Corn gluten meal	42.0	2.3	2.5	8.5	1.8
Distillers' corn dried grains	28.3	7.4	13.4	5.6	1.7
Distillers' whole slop	2.1	.6	.8	91.9	.3
Distillers' thin slop	1.1	.4	.2	96.3	.3
Hominy meal	11.0	8.0	5.5	10.0	2.6
Kafir corn	11.0	3.0	2.5	11.8	1.7
Lespedeza seeds	39.0	7.5	9.0	8.5	4.5
Molasses (cane)	3.2	—	—	25.9	8.5
Oats	11.5	4.6	11.0	9.5	3.5
Oat kernels	16.0	6.4	1.6	8.0	2.0
Sorghum grain	9.5	3.4	2.0	12.0	1.9
Soybean oil meal (New process)	44.0	1.5	7.0	8.4	6.4
Soybean oil meal (Old process)	41.0	5.0	6.5	9.5	6.2
Wheat	12.4	2.1	2.2	10.2	1.9
Wheat bran	15.4	4.0	9.5	10.1	6.0
Wheat mixed feed	16.0	4.4	8.3	10.1	5.2
Wheat germ	28.5	10.7	2.5	8.9	4.5
Wheat brown middlings or shorts	16.5	4.5	7.3	10.3	5.4
Wheat gray middlings or shorts	16.7	4.6	5.5	10.5	4.4
Feeds of Animal Origin					
Bonemeal (steamed)	7.1	3.3	.8	3.6	81.3
Buttermilk, liquid	3.3	.5	—	91.6	.7
Buttermilk, condensed	13.5	3.0	—	65.0	2.5
Buttermilk, dried	32.5	5.5	—	4.5	8.0
Fish meal	55.0	8.0	0.9	7.7	20.7
Meat scrap (50%)	50.0	7.5	2.3	7.5	26.0
Skim milk, liquid	3.7	.15	—	90.4	.8
Skim milk, dried	34.0	1.0	—	6.0	8.0
Whey, liquid	.9	0.3	—	93.4	0.7

Analyses by Department of Feed Control, Kentucky Experiment Station.