The hen is an economical transformer of food into a finished product. A flock of hens averaging 150 eggs per hen a year is not at all unusual. Such a flock will produce one pound of eggs for each four pounds of feed consumed. Each hen will produce five times her body weight in eggs in one year's time. For the year ending October 31, 1921, the flocks of 168 persons cooperating with the Missouri Agricultural Experiment Station on Demonstration Farms averaged 125 eggs per hen. The records from these farm flocks indicate that for the last four years for every dollar expended for poultry feed the hen produced over $2.00 worth of poultry products. To secure these results the following things are necessary:

1. That the food be properly selected.
2. That it be fed in correct proportions and in a judicious manner in order that the hen's digestive organs be kept in good condition.
3. That the hens be liberally fed so as to supply the nutrients necessary to maintain the body and have a surplus for egg production.
The problems of poultry feeding require good judgment and keen observation. Hens fed for egg production should have rations high in food elements which are found in eggs. A balanced ration for laying hens is a combination of foodstuffs in the proper proportion to produce the desired results. There must be a proper relation between the grains and ground feeds. Due allowance must be made in selecting the right kind of protein concentrates and the amount of fibre must be kept within reasonably low limits. While grains form a large proportion of a hen's diet, it should be remembered that one of the first principles of poultry feeding is that the hen cannot do well if fed on a strictly whole grain ration.

Not only does a ration of grain fail to furnish the proper food nutrients, but such a ration is difficult for the hen to digest properly. Many farmers fail in their poultry feeding because they attempt to feed a ration wholly of grain. Trials at the Missouri Experiment Station show that on such a ration hens seldom lay more than 60 eggs a year. The birds are afflicted with digestive disorders, liver and kidney troubles. One of the first principles of disease prevention is to feed rations suitable to the needs of the hens. Grain rations should be supplemented with ground feed mixtures commonly called mash. The addition of mash to the ration enables the hen to digest more feed. It also corrects digestive disorders.

The proportion of grains—commonly called scratch feeds—to the mixture of ground feeds (mash) varies with the composition of the mash and also with the season of the year. Under average conditions hens should consume at least one-half as much mash as scratch feed. There are some cases where the hen will consume as much mash as grain.

In addition to the scratch food and mash, hens must be provided with suitable mineral material which is indispensible for efficient digestion and the manufacture of egg shell. Succulent material also plays an important part in maintaining the health of the flock and a constant supply of clean, fresh water is of equal importance. In feeding poultry, then, the poultryman must consider the grain, mash, minerals, succulence, and water and must apply an economical, efficient feeding system.

SCRATCH FOODS

Scratch foods are whole or cracked grains which should constitute from one-half to two-thirds of the total ration. The scratch food furnishes heat, energy, fat, and material for the yolk of the egg.

Scratch grains are comparatively high in carbohydrates and low in protein. The chief point to consider in designing a scratch ration is to remember that not over one-third of the total scratch food should be grain with bulky hulls. This is necessary to keep the amount of crude fibre to a low level as the digestive apparatus of poultry is not provided with facilities for handling roughage to any extent. Too much bulk limits the digestion and should be avoided. Grains when fed in a heavy straw litter, serve to compel the bird to exercise, which is extremely desirable. For this reason many poultrymen prefer to feed cracked grains. The selection of grains to constitute a scratch food depends upon the relative price.

Corn.—In Missouri corn should form a large portion of the scratch food. In fact good results may be obtained by feeding as scratch food corn alone—
provided of course that it is supplemented with a suitable mash. Corn is palatable and digestible. For laying hens it may be fed as corn grits or as shelled corn. Fed on the cob, the hen may not exert sufficient effort to get enough. Green corn should not be fed as it is almost sure to cause digestive disorders. For the same reason chickens should never be fed moldy or musty food of any kind.

**Wheat.**—Wheat is one of the most popular poultry foods. However, it is expensive as compared to corn, and has little if any, additional feeding value. Where wheat is used, it will be advisable to mix it with corn rather than feed it as the only scratch food. In fact better results will be obtained if this is done. Frequently a low grade of wheat may be obtained at reasonable prices, and for feeding purposes it is equal to wheat of higher grade. But screenings of low grade are of little value. Weed seeds are undesirable.

**Oats.**—Oats are of value in scratch feeds only when fed in limited quantities. Not over one-third of the scratch food should consist of oats. Their use in a ration depends upon their availability, quality, and the price. Oat meal is an excellent poultry food, but where the hull is left in, too much energy is required to dispose of the hull and the digestive tract may become filled up with indigestible material, occupying space needed by other foods, resulting in poor production.

**Other Grains.**—Grains such as barley, cane, milo or kafir, may be used as portions of the scratch food to the extent of one-third to one-half of the total scratch food, the remainder of the scratch food of course, being corn. Rye should not be fed as it is unpalatable for poultry.

**MASH**

A mash is a combination of ground feeds. It should be composed of mill by-products and animal by-products. It should constitute from one-third to one-half of the total ration. The feeding of mash is important. The ground feed enables the bird to digest more feed. Mash affords a convenient way of introducing a protein concentrate which is necessary to afford the proper balance. Frequently the mill by-products are cheaper than the scratch food ingredients. Mash when fed dry is never over-eaten.

The chief features in designing a mash aside from palatability, is to have the proper mechanical make up. It should not be too bulky, too pasty or too concentrated. To afford proper bulk and to keep the amount of crude fibre within reasonable limits, at least one-fourth and not over one-third of the mash should be bran, or bran and alfalfa combined. To afford proper balance at least one-fifth of the mash should be some animal protein concentrate, such as meat scrap or tankage. The other ingredient may be shorts or cornmeal.

**Bran.**—Bran is the outside hull of wheat. It is bulky and when fed keeps the digestive tract in a laxative condition. It is high in ash. It is, however, low in digestibility, its chief value in the ration being that it gives the mash the proper mechanical make-up.

**Middlings.**—Middlings, frequently called shorts or shipstuff, is also generally found in poultry mashes. It is less bulky than bran, and its nutrients are more digestible. A mash too high in middlings is pasty. When fed it
should be mixed with bran. It may constitute from one-fourth to one-third the total mash.

Wheat Feed, Mixed Feed or Mill Run.—Wheat feed, mixed feed, or mill run, may be considered as a mixture of bran and shorts.

Cornmeal.—Cornmeal is frequently used as a mash ingredient. When the scratch food is largely corn it may be eliminated from the mash. Cornmeal must be handled with discretion. It is liable to pack and heat and mold unless mixed with some bulky material. Soured or musty feeds should never be fed to poultry. The danger of its becoming sour has resulted in many mashers being recommended which contain no cornmeal. Clean sweet cornmeal is a desirable mash ingredient.

Ground Oats.—Ground oats if low in fibre may be considered a substitute for middlings.

Alfalfa Meal.—Alfalfa meal is frequently found in commercial poultry mashers. It may be used as a partial substitute for bran. Its use should be limited to 5 per cent of the total mash.

Charcoal.—Charcoal may be incorporated into the mash at the rate of 1 pound to 100 pounds of mash. It is an absorbent of gases and may be used as an intestinal corrective.

Salt.—Salt may constitute 1 per cent of the weight of the mash. Its value is disputed. It must be well mixed because large quantities prove detrimental.

NITROGENOUS FEEDS

Grains and grain by-products are low in protein and will not enable the hen to lay efficiently. It is necessary to supply additional protein in concentrated form to balance the ration. The most successful protein concentrates come from animal sources. It is poor economy not to feed some animal protein concentrate. Increased returns more than make up for the additional expense. The common forms of “animal foods” for poultry are skim-milk, meat scrap, or tankage. Bugs and worms are rich in protein of the right kind, but it is a mistake to depend upon this source because the supply scarcely ever equals the needs of the flock. The regular supply of animal

Fig. 2.—Results per hen for one year. The ration is important.
FEEDING FOR EGG PRODUCTION

food should by no means be reduced during the insect season. Many flocks cease laying and molt early in the summer because the ration lacks animal protein. At the Missouri Agricultural Experiment Station it has been found that the presence in the ration of any of the above mentioned animal foods will increase the number of eggs laid by the hen from 5 to 6 dozen eggs per year as compared with the same ration containing no animal food. For each pound of meat scrap or tankage or its equivalent in skim milk (2 gallons) an extra dozen eggs was obtained. The cost of feeding the hen was slightly increased but the profits per hen were materially increased. For every dollar invested in meat scrap or tankage the extra eggs produced were worth from $4 to $7.

Meat Scrap.—Meat scrap is a by-product from the packing house. It should not be confused with table scraps. It contains from 50 to 60 per cent protein, the price usually being dependent upon its protein analysis. It is a cooked product which has been dried and granulated. In spite of its odor it is relished by the fowls. The best way of feeding is to mix in the mash using one pound to each 4 to 6 pounds of mash. Fine meat scrap prevents the chickens from picking it out of the mash.

Tankage.—Tankage is a product similar to meat scrap. It is not as popular as a poultry food although it is being used with equally satisfactory results. It usually contains a little more protein, due to the presence of blood. It has a less attractive odor, is cheaper than meat scrap, and lacks the uniformity possessed by meat scrap. Meat scrap or tankage should be rejected as a poultry food if it contains over 4 per cent fibre.

Skimmilk or Buttermilk.—Skimmilk and buttermilk have practically the same feeding value. They may be used as a substitute for meat scrap or tankage. The daily allowance for 100 hens is 3 gallons. In the winter it may not be possible to get the hens to drink the necessary amount, and in this case the mash should contain meat scrap or tankage. This is also especially desirable where the milk supply is uncertain and limited. Unless the hens drink the desired amount it should be considered as a supplement to the meat scrap or tankage rather than a substitute. Milk should be fed sour. In feeding milk, the pans require frequent cleaning to maintain sanitary conditions.

Dried Buttermilk.—Dried buttermilk is also used as a substitute for meat scrap or tankage. It is lower in protein and more expensive.

Semi-Solid or Condensed Buttermilk.—Semi-solid or condensed buttermilk is also used as a substitute for milk. It is usually diluted with water to the consistency of milk. In some cases it is fed without dilution.

Fish Scraps.—Fish scraps are dried products similar in feeding value to meat scrap and tankage and may be substituted for either.

Protein Concentrate From Vegetable Origin.—Such vegetable protein concentrates as cottonseed meal, oil meal, or gluten meal are frequently found in poultry mashes. Experiments at the Missouri Agricultural Experiment Station indicate, however, that they cannot be used as a complete or partial substitute for "animal protein concentrates". In fact their presence in the ration resulted in no increase in production as compared with similar rations containing no vegetable protein concentrate. Vegetable protein concentrates when used as a substitute for animal protein concentrates gave
better results when 5 per cent bone meal was added to the mash, but even then were not as efficient as mashes containing animal protein.

MINERAL FOODS

The common mineral feeds are flint grit, soft limestone rock, and oyster shell, and granulated bone. The function of grit is to assist the hen in grinding and mixing the feed. For this purpose the harder the grit the better. Soft limestone rock and oyster shell furnish shell-making material. The comparative value of soft limestone rock and oyster shell depends upon the softness of the rock. Grit and shell-making material should be kept before the hens all the time. The hen requires three times as much mineral matter when laying and unless it is supplied, egg production will be reduced or even completely checked. It is a mistake to neglect this cheapest of poultry foods. Granulated bone is not specially needed by laying hens but should be supplied for growing chicks.

SUCCULENCE

Green food plays an important part in poultry feeding. Its function is not so much to supply food nutrients as to assist in the digestion of other foods, and in keeping the digestive tract in good condition. It acts as a stimulant, appetizer, and tonic. Succulent plants cause hens to lay eggs with yellow yolks. So far as possible the green food should be grown on the poultry runs. In winter it may be supplied by feeding cabbage, mangel-wurtzels (large beets), sprouted oats, steamed clover or alfalfa, or boiled vegetables. Frequently a heavy stand of rye may be harvested daily in winter and given hens that are kept enclosed. Ensilage chopped fine is also occasionally used for succulence. Sowing of the yards to wheat, also furnishes green food in the fall and spring. This may be followed in summer with seasonable crops provided grass runs are not available. Where the supply of green food is limited the feeding of epsom salts at the rate of one pound to each 100 hens every two weeks is being recommended.

WATER

Failure to supply clean, fresh water will decrease egg production materially. Hens must have water. The egg is 65 per cent water. The more eggs a hen lays the more water she requires. The warmer the weather the more she will consume. If this important point is neglected not only will the production be less in number, but the eggs will be smaller in size. Ovarian troubles or digestive disorder may result from a shortage of water. A drinking stand 18 inches high upon which the drinking pail may be kept will assist in keeping the water clean. The drinking utensils must be kept clean and in case of outbreaks of cold or other diseases the water should be colored a claret red with potassium permanganate.
FEEDING FOR EGG PRODUCTION

RATIONS

The following is suggested as a daily ration for 100 hens:

**Scratch Food.**
- Corn (shelled or cracked) 10 lbs.
- Oats, wheat, kafr, or milo .... 5 lbs.

**Mash.**
- Bran .................................... 2 lbs.
- Shorts .................................. 2 lbs.
- Cornmeal ................................ 2 lbs.
- Meat Scrap or Tankage ....1½ lbs.

Another mash may be used:

- Bran .................................... 3 lbs.
- Shorts .................................. 3 lbs.
- Meat Scrap or Tankage ....1½ lbs.

Grit, oyster shell, or soft limestone rock, finely crushed and clean water should be available at all times.

Changes may be made in the ration with equally satisfactory results. Such changes may result in a more economical ration. Shorts may be substituted for the cornmeal; ground oats if low in fibre may be substituted for the bran, shorts and cornmeal. Ground wheat or wheat and corn ground together make an excellent base for a mash, and where home grinding is done, may be cheaper than other mash materials. Dried buttermilk may be substituted for the tankage or meat scrap—one pound of meat scrap has the same protein content as 1¼ pounds of dried buttermilk. Three gallons of sour skim milk may be substituted for 1½ pounds meat scrap. Corn alone may be used as a satisfactory scratch food; usually a variety is considered more desirable. Any change, however, must be gradual, otherwise the change may result in reduced egg production and possibly a partial molt.

METHOD OF FEEDING

The practice of poultry feeding, while governed largely by circumstances, should as far as possible be reduced to regular routine. Regularity, both as to time and amounts is one of the keynotes of success. The hens very soon learn when to expect their daily feed, and if they are disappointed the effect may be noticed in the egg basket. The poultryman should learn the characteristic needs of his flock and cater as far as possible to its desires. He should attend to his duties in a quiet manner, avoiding any unusual action which might frighten the hens or cause them to become excited. He should gain their confidence and make them feel that he is their friend. The occasional feeding of grain from the hand will very soon create pets and the extra time spent will be paid in full by better returns and more satisfaction in a task well done.

The grain portion of the ration should constitute approximately two-thirds of the total ration. These rations are designed with that proportion in mind. A bird should, of course, be allowed to eat all that it desires. The ration should be liberal at all times. Many hens molt prematurely in summer because they are not well fed. The best practice is to feed all the hens
will eat at all times. The object in feeding hens is to get them to consume the greatest amount of feed possible. The habits of a hen are quite largely developed by her food supply. If she is hungry she will steal, and few yard fences will keep her confined. She will roost near where she eats.

A well fed hen is easily confined and it is the well fed hen that returns the greatest profits. The good poultry feeder is the one who can keep his birds active and have them consume large quantities of food. Such skill not only results in the liberal consumption of food but is accomplished without getting the birds off feed. A good general rule is to let the birds get slightly hungry once a day, and then fill them good and full at least once each day. A bird's appetite varies from day to day and month to month. Weather conditions greatly influence the consumption of food. Birds in heavy laying condition have better appetites. These are points which the feeder himself must learn by observation. The consumption of grain is easily accomplished because grains are the more palatable. The method of proportioning the scratch food, however, greatly influences the consumption of mash. In winter the daily grain allowance is approximately 15 pounds for 100 hens. The morning feed should be not over 5 pounds. This should be buried deep in a heavy straw litter. Feeding a small amount of grain in the morning accomplishes two purposes. It keeps the birds exercising which is of extreme importance and it also encourages the consumption of mash which is equally essential. In winter it may be advisable to make extra visits to the poultry house and scatter a few handfuls of grain to keep the birds active. In summer it may be advisable to eliminate the morning grain feed entirely. At any rate the grain consumed during the summer months should not be more than two-thirds of that fed in winter. Usually the appetites of the hens will regulate the changes in summer feeding.

At night the hens should be given all the grain they will consume just before going to roost. This will vary but will be approximately 10 to 11 pounds daily for 100 hens. During the long winter nights it is important that this be fed just before the birds go to roost so that digestion may be carried on as long during the night as possible.

Mash.—Should constitute from one-third to one-half the entire ration. The production of eggs is dependent upon the amount of mash consumed. It should be fed dry in hoppers where the birds have access to it all the time. It is important that liberal feeding space for mash be provided. There should be one linear foot of mash hopper for each five to seven hens. For 100 hens a mash hopper which feeds from both sides should be 8 feet long. The advantages of dry mash feeding are that it saves labor, there is no danger of the hens over-eating, and food is always available so that each hen gets her share. One method of feeding the dry mash is to measure out definite quantities each day. This involves extra work but enables the feeder to check daily the amount which is being consumed. The amount actually consumed is dependent upon the amount of grain fed, and the appetites of the birds. A great deal depends upon the previous history of the hens. If dry fed as pullets, they take readily to the dry mash when in the laying house. Usually in the heavy laying season the feeder experiences no difficulty in getting the hens to eat enough of the mash. In winter and during the hot summer months it will probably be desirable to feed a moist
crumbly mash at noon each day. The extra consumption may afford just the extra nourishment necessary to enable the bird to produce eggs. Approximately three-fourths of a hen's food is required for body maintenance. The remaining one-fourth goes for production. Hens fed a three-quarter ration are in no condition to lay eggs. Where wet mash is fed it should be fed only in such amounts that it is readily cleaned up. The more mash the birds eat the more eggs they will lay. The daily allowance for 100 hens is 7½ pounds. If they will eat more one should not limit them.

**VARIETY**

Variety in the ration should not be over-looked. Surprises assist materially in keeping the birds on edge. The noon feed affords opportunity to provide delicacies which will be appreciated. The moist crumbly mash, the green food, the owner's extra visits to the poultry house with a handful of grain, keep the birds interested, awake and active. Some people prefer mixed scratch feeds due to the variety. Keeping the birds happy materially increases consumption which results in more eggs.

**EXERCISE**

The success of egg production depends largely upon the activity of the birds. Leghorns excel in egg production largely because they keep themselves physically fit. The inactive hen is a poor producer. Some hens exercise because of the joy of living, others need to be compelled to exercise. The heavier breeds are inclined to inactivity, and in a short time become too fat to lay. It is impossible to get a laying hen too fat to lay so long as she keeps laying. A hen must have a surplus of fat before she will start laying. To produce eggs requires all the capacity of the digestive tract.
However the non-laying hen with an accumulation of fat due to lack of exercise is in no condition to manufacture eggs. The circulation of blood to the ovary is restricted. This interferes with the normal functioning of the ovary and reduces egg production. Exercise can be encouraged by not over-feeding in the morning, and by feeding grain in a heavy straw litter. The skill of the poultry feeder is taxed by his ability to compel the birds to exercise. If underfed, the birds are extremely eager for the next grain feed. The digging of holes in the litter in their search for food, and the musical notes of content and comfort are indications of correct conditions.

**FEEDING HENS ON THE FARM**

The farm flock presents special problems of feeding not encountered by the special poultry enterprise. The same general principles apply although perhaps slight changes in the routine may be advisable. During cold weather it is advisable to keep the flock confined. At no time should hens be fed on bare yards, especially in winter. The farmer and poultryman alike should remember that cold feet and egg production do not go together and the birds should be protected from cold floors by a heavy straw litter. Where it is desired to allow the hens to scavenge for waste, they may be kept confined to the poultry house until noon so they will have access to the dry mash. They can then be turned loose for the day, receiving of course all the grain at night they will consume. To depend too much upon the scavenger activities of the hen results in damage to crops, and invariably brings poor egg production. Hens compelled to scratch for a living use up so much

![Fig. 4.—An excellent combination: good stock properly housed and well fed by a good poultryman.](image-url)
energy that little surplus for egg production remains. It is folly not to feed the hens well all the time. The best plan is to feed liberally each day, a practice which will result in production and not lessen the hen's value as a scavenger.

USE OF ARTIFICIAL LIGHTING

Artificial lighting of the poultry house is becoming a general practice. The short days of winter do not afford the hen sufficient time to consume the food necessary to keep herself warm and have a surplus for egg production. Also the time between night and morning feedings is so long that the hen's crop cannot hold enough feed to carry her through the long night interval. Artificial lighting will enable the hen to consume more feed. Some people light the poultry house so that the time spent on the roost is about the same as in spring, using light either in the morning or evening. A practical plan is the evening lunch. Grain is placed in troughs and the poultry house lighted for one-half hour, 8 p. m. to 8:30 p. m., during which time the hens fill up. It is not considered wise to use lights with late molting hens until after January 1, but with early molting hens and pullets, lighting may be practical from November 1 to March 1. The brighter the lights, the better.

FALL FEEDING

During the summer the grain ration should be reduced so that the hen consumes as much mash as grain. With the approach of winter the hens should be fed more grain until eventually the grain ration amounts to approximately 15 pounds daily for 100 hens. This increase in grain is necessary to conform with the requirements of the hen when her body requires more heat-producing food. The mash for 100 hens should be 7 1/2 pounds daily throughout the year.

GENERAL INFORMATION

Hens eat from five to eight pounds of feed a month, or 60 to 80 pounds in a year. The daily food eaten by a hen is from three to four ounces. The daily ration for 100 hens is from 20 to 25 pounds.

A hen will drink about 7 pounds of milk a month. One hundred hens drink about 3 gallons of milk daily. Where milk is fed the hens should consume one pound of milk for every pound of feed.

A hen consumes about 5 pounds of grit and oyster shell in one year.
Essentials of Successful Poultry Feeding

1. Feed liberally all the birds will consume.
2. Feed grain and mash in proper proportions.
3. Feed animal food such as meat scrap tankage or skimmilk.
4. Provide succulence.
5. Provide clean, fresh water.
6. Provide hard grit and soft limestone rock or oyster shell.
7. Compel the birds to exercise.
8. Give them regular attention.