Feeding Laying and Breeding Hens

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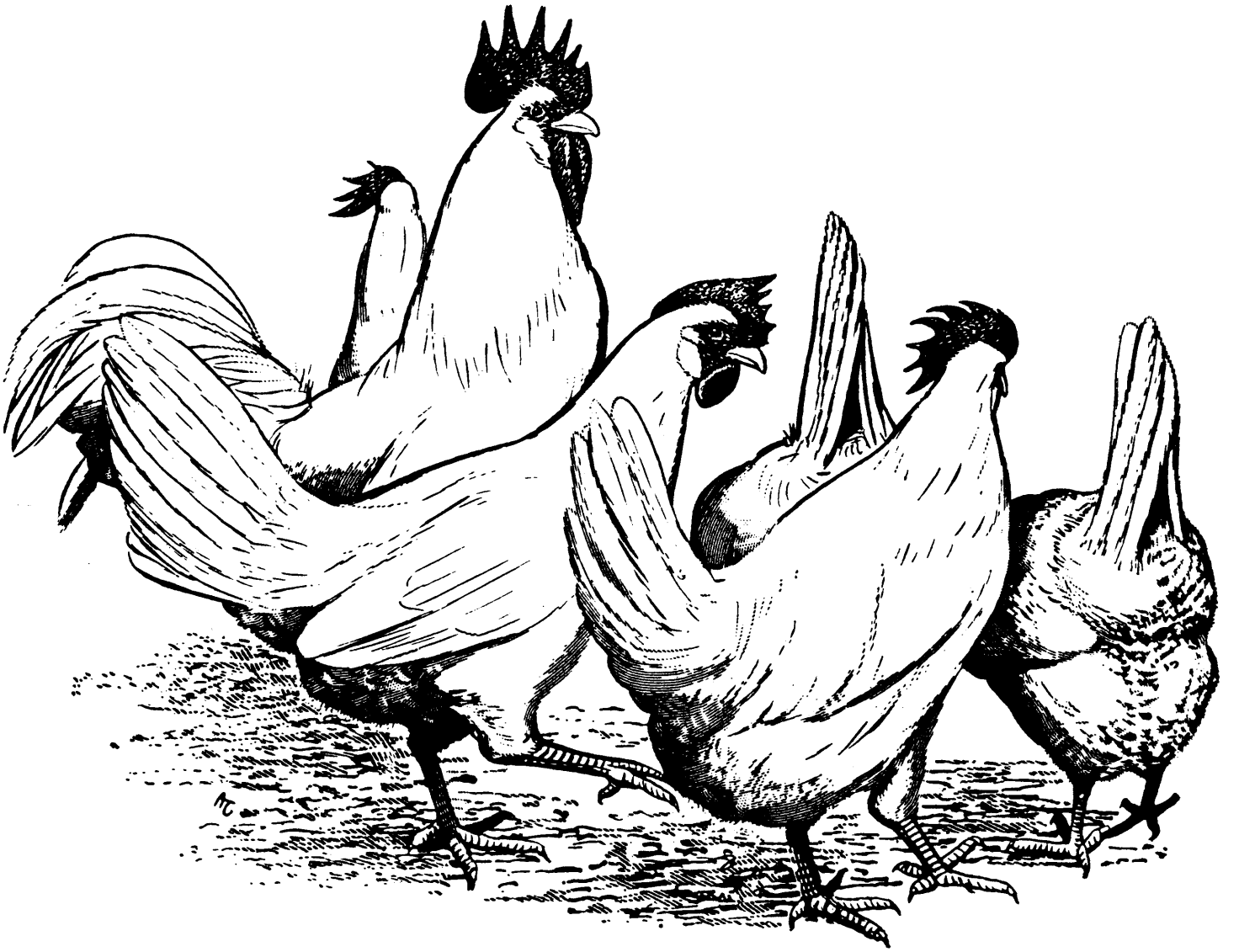

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Contents

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Feeding Laying and Breeding Hens

The production of eggs for market is an enterprise in which only a relatively small profit per dozen is made by efficient operators. The profit margin does not provide sufficient leeway for individual producers to experiment with feeds or methods of feeding. Until experience warrants, the producer will be more successful by accepting proved feed combinations and adhering closely to some definite, approved feeding method.

Feed represents the largest cost item in the business of producing eggs. Mass production practices, increased egg production per hen, year-round confinement of laying stock in houses and cages, and many other deviations from natural methods have increased the complexity of the problem. Recent findings in poultry nutrition research have not only reduced feed costs per dozen eggs through more efficient rations, but have made it possible to use less expensive feedstuffs in these rations. Continued research should lead to still greater efficiency.

FEED NUTRIENTS

Content of Feeds

Both feeds and eggs contain the same nutrients —proteins, carbohydrates, fats, minerals, vitamins, and water. The proportion of each nutrient varies in different feeds. The producer must aim to furnish the correct supply of each for egg manufacture. Only a portion of each nutrient in poultry feeds can be assimilated by the birds, hence the variation between actual feeding value and chemical analyses. For example, one feed may contain a large amount of fiber that will affect the digestibility or availability of other nutrients present. Some proteins are more complete for the required amino acids than others; consequently their feeding value is greater, though chemical analysis might show them to be the same.

Nutrients

• *Carbohydrates and fats.* Most grain feeds supply carbohydrate in large amounts but do not contain protein, minerals, or vitamins in amounts or quality to maintain egg production. Carbohydrate is made up of nitrogen-free extract and crude fiber. While nitrogen-free extract serves as a major source of energy, only part of the crude fiber can be used. Grains vary greatly in fiber content, and the use of high-fiber feeds is dependent on energy needs.

Fat also serves as a source of energy and is found not only in grains but also in numerous other feedstuffs such as meat or fish meals. It is also available as a byproduct of the food processing industry as animal or vegetable fat. Fat is not yet used extensively in laying rations.

Carbohydrates and fats provide the energy that the hen requires. This requirement is usually expressed as metabolizable energy. It is that energy utilized for metabolism, maintenance, work, egg production, and growth or fat deposition. The unit used is kilocalories.

Feed intake has been observed to be related to the energy content of the diet. *As the energy content increases, feed consumed decreases provided rations are adequately balanced from the standpoint of other nutrients.*

• *Proteins.* Protein is a highly important nutrient. There are many different proteins. In poultry feeding, the source and quality of any protein used must be considered more important than its quantity. Proteins are broken down into amino acids in the process of digestion. Amino acids are classified as "essential" or "nonessential." The "essential" amino acids are those that cannot be synthesized in sufficient quantity to meet the bird's nutritive requirement and therefore must be supplied in the diet. Since most protein sources will not supply all essential amino acids, it is common practice to use combinations of protein-containing materials, or in certain instances actual amino acids such as methionine and possibly lysine if they are commercially available.

The poultry industry at one time depended on liberal feeding of milk products, meat meal, and fish meal as major sources of protein concentrates and vitamins. Currently, however, it depends heavily on such vegetable protein concentrates as soybean meal and to a lesser extent cottonseed, alfalfa, or corn gluten meals; various grain byproducts; brewery and distiller's byproducts; and other meals such as peanut, sesame, sunflower, and pea. It has been shown that vegetable proteins must be supplemented with certain animal protein supplements and vitamins for optimum hatchability and viability of progeny. Furthermore, to adequately

balance rations from the standpoint of their amino acid content certain amounts of animal protein or methionine may be required.

• *Minerals.* Minerals are essential, and unless care is taken that there is a sufficient supply available, both egg production and hatchability may decrease. Supplying minerals is much more important under present intensive poultry-growing conditions than it was under small-flock and free-range conditions.

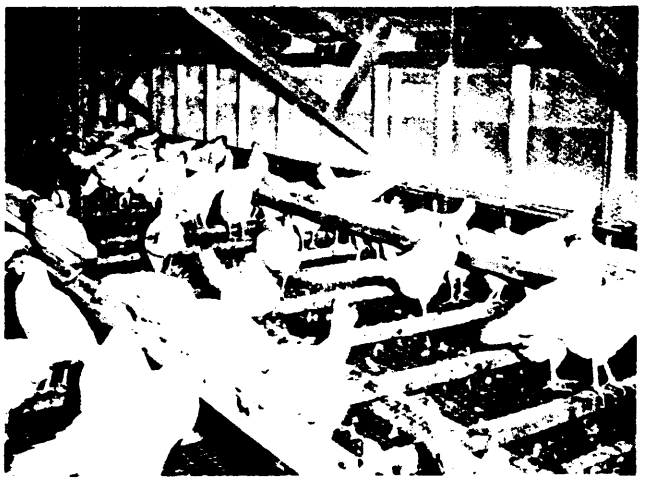
Grains, their byproducts, and other vegetable feedstuffs are low in minerals and must be supplemented with ingredients of higher mineral content. They do not supply calcium, phosphorus, sodium, chlorine, and manganese in adequate amounts. A number of other minerals are of vital importance, but are usually supplied in sufficient amounts in natural feedstuffs.

Oystershell or limestone grit kept before layers at all times supplies the needed calcium for eggshells. Dicalcium phosphate is fed to supply both calcium and phosphorus. Manganese is required for shell strength and normal hatchability and is supplied as manganese sulfate. Iodized salt supplies sodium, chlorine, and iodine. Care should be taken that all added minerals are evenly distributed throughout the mash in the mixing process.

• *Vitamins.* Vitamins are nutrients required in minute amounts for normal health, growth, and reproduction. Some are stored in the body in limited amounts. Several have an important bearing in feeding for egg production and breeding purposes. These are vitamins A, B_{12}, and D_3, as well as riboflavin and pantothenic acid. Others either are present in sufficient quantity in the usual feeds or are not required.

Vitamin A is supplied as carotene in green feed, alfalfa meal, and yellow corn. Commercially prepared sources of vitamin A are available in a dry stabilized form. Vitamin A and D feeding oils also supply liberal amounts of vitamin A. Vitamin A is necessary for egg production, hatchability, and viability and growth of chicks. A shortage decreases resistance to diseases, particularly those of the respiratory tract and eyes.

Vitamin D_3 is available in commercially prepared products such as irradiated animal sterols and certain fish oils. These are the only dietary sources. The vitamin strength of oils varies. Vitamin D_3 does not deteriorate in mixed feeds as rapidly as vitamin A. Vitamin D_3 is necessary for the utilization of calcium and phosphorus. A deficiency results in decreased egg production and shell thickness and faulty bone formation or rickets.



Layers fed by mechanical feeders. Placing the feeders over the roosting pit helps keep floor litter clean.

Riboflavin is found in liver meal, dried brewers yeast, milk byproducts, alfalfa meal, fish meal, meat meal, and various fermentation products. The crystalline vitamin is also available. This vitamin not only improves egg production, but is also needed in greater amount for the production of eggs to be saved for hatching purposes.

Pantothenic acid is required for both egg production and normal hatchability as well as growth, viability, and the prevention of dermatitis in chicks. While most rations meet the requirement for egg production, some may not contain enough of the vitamin for optimum hatchability. Feedstuffs containing this vitamin are: liver meal, dried brewers' yeast, dried whey, and alfalfa meal. A pure source is also available as calcium pantothenate.

Vitamin B_{12}, the newest member of the B-complex series, has been shown to be necessary for normal hatchability as well as subsequent growth and viability of chicks. It occurs chiefly in animal protein supplements such as fish meal, condensed fish solubles, liver meal, meat meal, and various fermentation products. Plant protein supplements, on the other hand, are low in vitamin B_{12} content. Although a certain amount of synthesis of the vitamin may occur when birds are housed on built-up litter, this practice does not provide a reliable source of vitamin B_{12}. Use of 5 percent fish meal or 3 percent condensed fish solubles in an all-mash feed will meet the breeder hen's requirements for the vitamin, as will commercially prepared vitamin B_{12} supplements.

An unidentified factor(s) necessary for normal hatchability of hens fed an all-vegetable type ration adequately supplemented with vitamin B_{12} and other known nutrients has been reported. Although differences in hatchability are small, it is believed

desirable to include carriers of this unknown nutrient(s) in the ration of the breeder hen. Animal protein supplements such as fish meal, fish solubles, or meat meal may provide an adequate level of this factor.

Use of Feeds

The major use of feed by the hen is for body maintenance purposes which approximates 65 to 75 percent of normal feed intake. Eggs are manufactured by the hen from the liberal supply of essential nutrients consumed in excess of body requirements. A laying hen will deplete her body of reserve nutrients only to a limited extent, then cease production. Hence it is necessary to keep before her a reasonably constant supply of the essential nutrients so that she will not have to draw on this reserve.

Variety and Palatability

A combination of several feeds permits the deficiencies of one to be offset by the nutrients of others. Palatability of feeds is important as it relates to adequate feed consumption for sustained egg production.

Nutritional Requirements

Considerable data on nutritive requirements for the production of eggs for commercial and hatching purposes have been obtained. Table 1 lists recommended levels of protein, vitamins, and minerals to be considered in the formulation of layer and breeder rations. Many nutrients are not included since they will always be supplied in adequate amounts in commonly used feed ingredients. The requirements for some nutrients have not been established. In rations for layers, allowances for vitamins A and D are considered the same as for breeders.

Effect of Feeds on Internal Egg Quality

Excessive feeding of highly pigmented feeds such as alfalfa meal, kale, rape, rye pasture, and certain weeds like shepherd's purse, mustard, and pennycress will give an undesirable deep color to egg yolk. Yellow corn will also darken yolks but its use is generally accepted. A large percentage of cottonseed meal in the ration will result in yolk color for storage eggs varying from salmon and dark green to nearly black, and the whites will vary from normal color to pink. Excessive amounts of onions, fish meal, and fish oils may give the eggs an undesirable flavor.

Table 1. Recommended Nutrient Allowances for Laying and Breeding Hens[1,2]

Nutrients	Amount
Protein, percent	15
Crude fiber, percent	6[3]
Metabolizable energy, kcal/lb.	1,295
Vitamins	
Vitamin A activity, U.S.P. units/lb.	3,036
Vitamin D_3, I.C. units/lb.	340
Riboflavin, mg./lb.	2.1 (1.2)[4]
Pantothenic acid, mg./lb.	5.4 (1.2)
Vitamin B_{12}, mcg./lb.	1.7 (?)[5]
Folacin, mg./lb.	0.19 (.13)
Minerals	
Calcium, percent	2.75[6]
Phosphorus, percent	0.5
Sodium, percent	0.15
Manganese, mg./lb.	15.0 (?)
Iodine, mg./lb.	0.14
Amino acids, percent	
Methionine + cystine[7]	0.5
Methionine	0.27
Arginine	0.8
Lysine	0.6
Tryptophan	0.11
Leucine	1.2
Isoleucine	0.5
Threonine	0.4

[1] Adapted from 1977 *Nutrient Requirements for Poultry*, National Research Council Publication ISBN-0-309-0 02725-X.

[2] Allowances: Vit. A, req't. x 1.67; Vit. D_3, req't. x 1.5; other vits.: req't. x 1.2; other nutrients, no safety margin needed.

[3] As a general rule, crude fiber should not exceed this value.

[4] Figures in parentheses represent a decreased allowance when hatching eggs are not desired.

[5] Where "?" are shown, no requirement has been established. Experience indicates that commercial rations generally contain an adequate level of these nutrients.

[6] This level is included if no additional calcium supplement is fed (see text p. 9).

[7] Based on content of natural feedstuffs. Deficiency made up by methionine.

FEEDS FOR EGG PRODUCTION

Ration Formulas

In formulating rations for egg production or breeding purposes no one formula is best, neither is any particular feed ingredient indispensible. The type of ingredients to use depends on several factors—foremost are nutritive content, palatability, availability, digestibility, and price. The end result requires that *rations be designed for the purpose intended.* For example, with breeder rations, as noted in Table 1, higher levels of certain nutrients are recommended. These higher recommendations insure a sufficient "carryover" of certain nutrients from the hen to the egg for normal hatchability, and from the egg to the chick for normal viability and optimum growth. In the formulation of any ration, not only should the allowances cited in Table 1 be followed, but also information on the

nutritive content of feedstuffs should be available. A summary entitled *United States-Canadian Tables of Feed Composition,* published by the National Research Council, Washington, D. C. as publication 1684, provides extensive information on composition of feedstuffs.

Since ration formulas are subject to periodic revision, they are not included in this bulletin but various types of ration formulas may be obtained on request in leaflet form from the Department of Poultry Science.

Mash Rations

All manufactured feeds, unless further processed, are in mash or ground form. Whether or not they are to be fed as the only source of nutrients or further supplemented with grains is dependent on the feeding system selected (see page 7).

Pellets

Manufactured feeds are also available in pellet or crumbles form. Pellets may also be used in a supplemental feeding program (see page 9). Advantages of pellets or crumbles over mash feeding are: reduces feed wastage; eliminates selection of ingredients within a mash; permits more efficient use of high-fiber feeds; and reduces presence of salmonella. Disadvantages of pellets or crumbles are: increases cost; increases moisture content of droppings; and increases feed intake without increasing production.

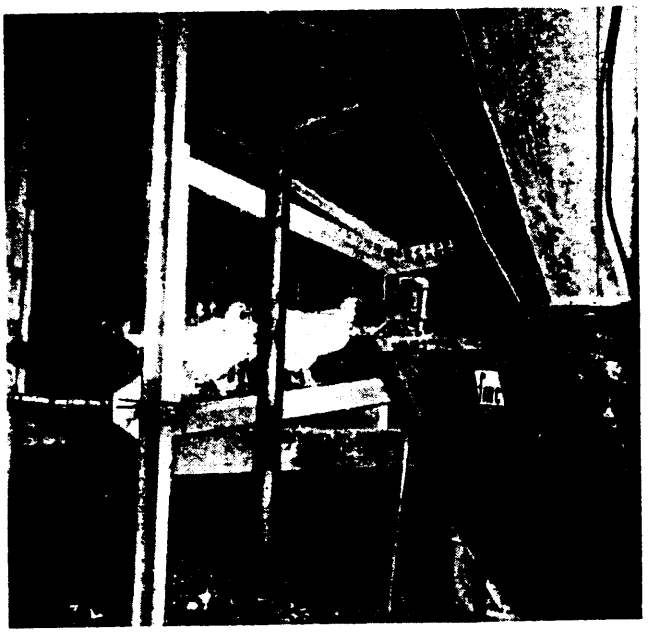
Scratch Grains

Oregon produces a surplus of high-quality wheat, oats, and barley. It is wise to make generous use of these home-grown feeds where economically feasible.

Wheat is a good energy source. When economically available, it serves as an excellent grain as it is high in carbohydrate and low in fiber. Research at the Oregon Agricultural Experiment Station shows it may completely replace yellow corn, having a relative value of about 95 percent of corn.

Yellow corn is palatable and serves as an excellent source of energy. Oregon's corn production is limited. Large amounts of corn are shipped into the state in spite of high transportation costs.

Barley is available in considerable quantity in Oregon. It contains less energy than corn or wheat, but more than oats. It may be substituted for corn, oats, or wheat, but normally should not constitute more than 75 percent of the scratch feed. Barley is less palatable than corn, wheat, or oats, and poultrymen should gradually teach the birds to eat it rather than suddenly include it into the scratch mixture.



Labor-saving mechanical feeders are frequently used for layers in community cages. Bulk feed bins may empty directly into the feeder.

Oats are classed as a low-energy feedstuff, but may be used when available. Heavy, thin-hulled oats have a better feed value than light-weight oats. They are not quite as palatable as wheat or corn, probably because of their higher fiber content. Oats normally should not be used in excess of 50 percent of the scratch grain by weight.

Kafir, milo, buckwheat, and other less common grains are not generally available in Oregon in sufficient tonnage to make them economical feeds, but are satisfactory substitutes when available at reasonable prices.

A scratch grain mixture is determined more by availability and prices of ingredients than by any set formula. Although there are experimental data to show that layers will perform satisfactorily when they are fed a single grain as a scratch feed, not less than two different kinds of grain should be used in the scratch mixture. Three suggested scratch mixtures for laying and breeding hens are listed in Table 2. Selection or variation of any one of these mixtures may depend on local conditions.

Water

Many poultry producers do not appreciate the amount of water poultry require for maintenance of health, growth, and egg production. It is both the cheapest and most plentiful nutrient that poultry consume. It is an essential constituent of all body tissues and for all life processes. Unfortunately, it is sometimes overlooked because it is often taken for granted.

Table 2. Suggested Scratch Mixtures for Laying and Breeding Hens

Ingredient	High energy	Medium energy	Low energy
	lbs.	*lbs.*	*lbs.*
Barley	500	1,000	1,000
Corn[1]	1,000	500	.....
Oats	.....	500	1,000
Wheat[1]	500	.....	.....
Total	2,000	2,000	2,000

[1] May be substituted for each other or replaced with milo.

Water is necessary to enable the chicken to carry on its normal body functions. It softens the feed for digestion and aids in assimilation. As an important part of the blood, water distributes the digested food to all parts of the body. It serves as a lubricant for joints, muscles, and body tissues. It carries waste products to the points of elimination. And it helps poultry control body temperatures.

Since chickens can't perspire, they must keep cool by breathing. In hot weather nearly half of the water they drink is evaporated through their respiratory system. This evaporation helps control their body temperature.

Water actually constitutes approximately 57 percent of the body weight of an adult bird. Water becomes even more important as the pullets come into production. They need it to manufacture eggs—73 percent of the contents of an egg is made up of water, more than a pint of water in every dozen eggs. Thus, water consumption increases as rate of lay increases (Table 3).

Water consumption is also affected by temperature. As outdoor temperatures rise during the summer, water consumption increases. Water consumption at 95°F is double that at 70°F.

Hens seem to prefer water within the range of 50° to 55°F, or about as it comes from most wells and springs. If the temperature varies in either direction from this range, consumption is cut back. In winter when water temperatures approach freezing, water consumption by layers may drop as much as 25 percent. In the summer water consumption is reduced noticeably when the water temperature reaches 90° to 95°F. When it reaches 105°, the birds will not drink until they are very thirsty, and they virtually refuse to drink when the temperature reaches 112°F. The temperature of the water in unshaded waterers can easily reach this temperature on a hot summer day. Remember, when water consumption drops, so does egg production.

If the hens are deprived of water for as long as 24 hours, egg production will drop as much as 30 percent. Deprive the flock of water for three days and egg production will stop—with the birds going into a molt.

Water should be where the chickens can see it quickly and drink it easily. Place the waterers so that no bird will have to walk more than 10 feet to drink.

Table 3. Approximate Number of Gallons of Water Required Daily for 100 Layers, Weighing 4 Pounds Each, at Temperatures From 70° to 75°F.

Percent of production	Gallons of water per 100 birds daily
30	4.8
40	5.1
50	5.4
60	5.8
70	6.1
80	6.5
90	6.8
100	7.2

FEEDING SYSTEMS AND PRACTICES

All-Mash Feeding

All-mash or complete feeds are fed to commercial egg production birds on a free-choice basis and should always be available in feeders. All-mash layer rations usually contain 15 to 17 percent protein, whereas mashes to be fed with scratch grains should contain 20 percent protein. *Scratch grains should not be fed to layers receiving an all-mash feed.*

Where heavy breed layers are used for production of hatching eggs for broilers and flock replacement breeders, specially restricted feeding programs are recommended to control over-consumption and obesity in the layers. These programs vary according to the particular strain of bird being used and are closely related to body weight, age, ratio of lay, and environmental temperature. Virtually all suppliers of breeder chickens have detailed schedules that should be followed. In the absence of such feeding schedules, free-choice programs should be used and the hens monitored for excessive fat deposition and/or increase in body weights.

Most trough feeders hold only a limited supply, necessitating daily fillings. The use of mechanical and drum-type feeders with all-mash feeding programs is increasing. With this innovation the feed supply may be available to the bird for several days

or longer. In any event, close observation should be kept of feed consumption and the general well-being of the birds.

Economical use of mash is influenced by the amount of trough space provided. Insufficient trough space promotes crowding and reduces feed consumption. A minimum of 25 lineal feet of trough or hopper space should be available for each 100 hens. A regular trough 8 feet long with feeding space on both sides provides 16 lineal feet of hopper space since the hens eat from both sides.

The tentative daily feed requirement per 100 layers based on body size and rate of production is given in Table 4. Thus it can be seen that 100 birds, averaging 4 pounds in weight and laying 60 eggs daily, will consume approximately 24 pounds of feed per day. These amounts may also be influenced by the energy content of the feeds. High-energy feeds will decrease the amounts of feed required, whereas low-energy feeds will bring about increases in feed consumption.

TABLE 4. APPROXIMATE DAILY FEED REQUIREMENTS FOR 100 LAYERS, AS INFLUENCED BY BODY WEIGHT AND RATE OF LAY[1]

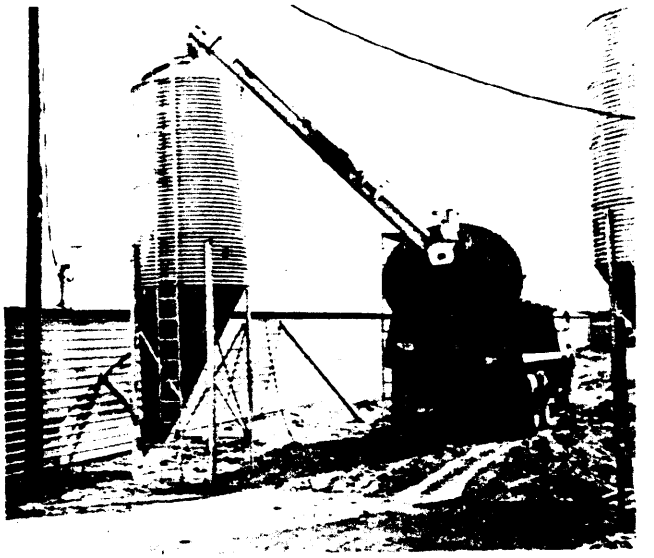
Body weight	Daily feed required per 100 birds for various production rates, by percent of lay				
	0%	20%	40%	60%	80%
	lbs.	*lbs.*	*lbs.*	*lbs.*	*lbs.*
3 pounds	12.8	15.6	18.5	21.3	24.2
4 pounds	15.5	18.3	21.2	24.0	26.9
5 pounds	17.9	20.7	23.6	26.4	29.3
6 pounds	20.2	23.0	25.9	28.7	31.6
7 pounds	22.3	25.1	28.0	30.8	33.7

[1] Based on data by T. C. Byerly, 1941.

Mash-Scratch or Concentrate Feeding

When supplies of locally grown grains are economically available, a mash-scratch feeding program may be employed. The mash that is fed with scratch grains must contain more protein, vitamins, and minerals than when feeding on an all-mash system since these nutrients are usually concentrated to a greater extent in the mash and not in the scratch grains.

For the conventional mash-scratch system where the scratch grain comprises 50 percent of the total feed intake, the protein content of the mash used should be 20 percent (Table 5). When it is desirable to feed greater amounts of scratch grains, protein concentrate mashes containing up to 40 percent protein may be used. If an all-mash feeding program is desired, protein concentrate



Much feed is delivered to commercial egg farms in specially designed trucks and emptied into bulk bins from which it often goes into a mechanical feeder.

mashes are available to which the proper ratio of *ground* scratch may then be added and mixed (Table 5).

Use of Scratch Grains

Scratch grains are usually fed in the late afternoon. Scratch grains may be fed in hoppers or scattered on top of the litter. Feeding some of the scratch in the litter may encourage the birds to stir the litter. Overfeeding grain will result in decreased consumption of mash and an inevitable drop in egg production since most of the proteins, vitamins, and minerals are in the mash. Underfeeding will increase costs resulting from poor utilization of protein and other nutrients.

It is sometimes necessary and desirable to control the amount of energy available to layers. This can be most effectively accomplished not by vary-

TABLE 5. RECOMMENDED PROTEIN LEVELS FOR MASHES WITH DIFFERENT MASH-SCRATCH RATIOS[1]

Ratio of mash to scratch used	Percent protein required in mash
1:0[2]	15
1:1	20
1:2	25
1:3	30
1:4	35
1:5	40

[1] Assuming a protein requirement of 15 percent and 10 percent as the average protein content of the scratch grain mixture used.

[2] This ratio is the all-mash system of feeding.

ing the ratio of mash to scratch, as is often practiced, but by increasing or decreasing the concentration of high- or low-energy grains in the scratch mixture. For example, during the winter months when energy needs are greater, larger concentrations of corn, wheat, or milo may be employed in the scratch mixture. (See Table 2.) On the other hand, during the summer when feed intake sometimes decreases due to higher environmental temperatures, lowering the energy content by the use of oats and barley will tend to increase consumption.

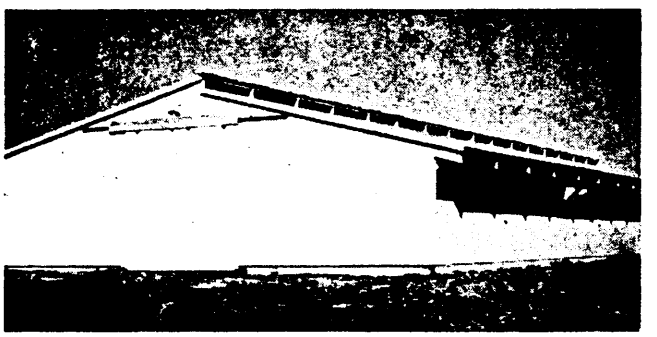
Supplemental Feeding

Occasionally it is necessary to vary the routine method of feeding. Supplementing with more appetizing feeds to increase food intake will meet such emergencies as sharp reductions in production, partial molts, sluggish appetites, attempts to hold up production through the molting season, and unfavorable temperature conditions. Some supplemental systems are: intermittent use of high-level antibiotic feeds, two to four pounds of pellets fed daily to each 100 hens, and about 2 pounds of mash moistened with water per 100 birds.

Except for the use of antibiotics, it is sometimes difficult to terminate the system once a supplemental feeding program has been initiated.

Phase Feeding

This is a method wherein the protein, amino acid, and mineral content of the ration is varied for increased economic efficiency in order to meet the bird's varying physiological needs for growth and egg production during the production cycle. Thus, depending on rate of production, age, body size, and environmental temperature, the protein content of the diet may vary from 15 to 19 percent (See Table 1). In general, there is serious doubt that the advantages of phase feeding are presently great enough in the Pacific Northwest to offset the extra expense and effort required.



Many pullets never see the open range. A single well-planned building may be used for brooding, raising pullets in confinement, housing breeders or layers for market eggs.

Oystershell and Grit

Some rations require free choice supplementation with oystershell or limestone grit. Because of the increase in caged layers and mechanical feeders many all-mash rations are now formulated to contain a sufficient quantity of calcium in the form of limestone flour. No added oystershell is then required.

Even though a ration may contain 2.75 percent calcium (see Table 1), this may not be an adequate amount under all conditions, especially for adequate shell thickness. The trend toward smaller body size and high-energy type rations with the accompanying decrease in feed consumption have contributed to this. The fact that layers have been selected continually for increased egg production is also a factor. A method has been reported for estimating calcium needs for layers using the criteria of feed per dozen eggs (Table 6).

Grit is generally fed in separate troughs. The use of grit with all-mash rations is optional and may be desirable with a mash-scratch feeding program. Many producers prefer a hard, acid insoluble grit because it lasts longer and aids in breaking down feeds high in fiber. Others use soluble limestone grit because, like oystershell, it supplies calcium. Caution must be exercised in using limestone grit to avoid excess magnesium sometimes found in dolomitic limestone.

TABLE 6. ESTIMATED LEVELS OF CALCIUM IN RATIONS FOR VARYING AMOUNTS OF FEED REQUIRED PER DOZEN EGGS[1]

Feed per dozen eggs	Calcium in ration[2]
lbs.	%
3.0	4.0
3.5	3.4
4.0	3.0
4.5	2.7
5.0	2.4
5.5	2.2
6.0	2.0

[1] Adapted from data of Combs and Helbacka, 1960.

[2] Calculated from (.12 ÷ feed/doz. eggs) 100, assuming .12 lbs. of dietary Ca is required to produce a doz. 2 oz. eggs.

FEEDING AND HOUSING NEW PULLETS

The time or age at which pullets are housed in permanent laying quarters may vary considerably depending upon the strain of chickens, individual preference of operators, weather, and pressure of other work.

Housing pullets shortly before egg laying starts is desirable but may not always be consistent with maximum utilization of buildings. It should not be delayed after 10 to 15 percent egg production. There is also some interest in rearing pullets in the same pens or houses where they remain as layers. This saves labor and reduces stress to the pullets due to moving them, but will increase housing costs.

Rearing pens or range houses should be equipped with a few nests for those pullets that lay before being moved into their permanent laying quarters. Pullets that form the habit of laying on the floor or ground while on range become easy prey for cannibalistic and curious mates when they continue the habit in the more crowded laying house.

Feed should be readily available to encourage feed intake for the first few days after housing. A few extra troughs of feed placed on the floor will help prevent any decline in feed consumption after housing. Likewise, if radical changes are made in watering equipment, additional open water containers will be helpful during the changeover.

Replacement pullets should be changed from the developer mash to the layer or breeder mash when egg production commences. It is not a good practice to change feed at the same time that the pullets are housed. Make no more major changes at one time than is necessary.

Pullets should be housed according to their physical and sexual maturity. They should be housed before the first pullets begin laying—4½ to 5 months of age for early maturing strains.

A number of special feeding programs have been devised for heavy-breed pullets to limit feed intake, delay sexual maturity, and increase initial egg size. These involve: use of high-fiber diets and/or restricted feeding; use of low-protein, imbalanced-protein, or lysine-deficient rations; and use of appetite suppressants. The advantage of one program over another has been quite variable. An understanding of nutritional principles is necessary since to maintain the bird in an adequate state of health, its nutritional needs for body maintenance must be met. Further, management practices also become more critical; for example, controlling cannibalism, providing adequate feeder space so all birds can eat at once when feed restriction is practiced—to mention only two.

FEEDING BREEDING HENS

As previously noted, a more complete ration is required to meet the needs of hens producing hatching eggs than of those producing commercial eggs. Rations formulated for commercial egg production—often called layer ration or laying mash—do not always meet the needs of the breeding flock. The fact that a flock maintains high egg production on an egg mash is no guarantee that high hatchability or strong viable chicks will result.

Breeder hens require greater amounts of vitamins A, D, and B_{12}, folacin, riboflavin, and pantothenic acid than do laying hens fed for market egg production. Similarly, breeder hens require greater amounts of manganese and iodine. Whenever practical, a breeder ration should be fed 2 to 4 weeks prior to saving eggs for hatching.

FEEDING LAYERS IN CAGES

Most commercial egg production is now carried on with wire cages with 2 to 5, and sometimes with as many as 25 to 30 layers per cage in environmentally controlled houses. A few use individual cages. Most breeder flocks and some market-egg flocks are kept in conventional type poultry houses on floors with litter.

Birds in wire cages receive no additional nutrients from poultry house litter, soil, or pasture. Therefore, the ration fed, usually in all-mash form, must be complete and balanced with respect to nutrients required or results are certain to be unsatisfactory. Further, layers must have easy access to water.

A view of a modern commercial egg facility in Oregon.

In cage setups equipped with mechanical feeders, the use of an all-mash ration is most desirable. In some cases, oystershell and hard grit are also included. It should be pointed out, however, that with certain types of mechanical feeders, mixing grit in the mash may result in damage to the equipment.

OTHER MANAGEMENT PRACTICES

Artificial Lights

Lights may be used for maintaining egg production during that portion of the year when there is less than 12 hours of daylight. In Oregon, lights are generally in use from September to April. Lights may be used in the morning, evening, or during either period to supply 12 to 14 hours of continuous light. Usually light intensity of ½ to 1 foot candle (5 to 10 lux) at bird level is enough to stimulate egg production in chickens. A 60-watt bulb is usually adequate for each 200 square feet of floor space, and should preferably be placed over the feeders. A cone-shaped reflector may be employed. Suitable time clocks and light intensity controls are now available.

Care of Broody Hens

Abuse of broody hens may result in extended periods of non-productivity. Broodiness may be curtailed by confining these hens to wire- or slat-floored cages that are readily accessible, and supplying them with ample feed and water. Restricting feed or water is not desirable. When observed early, broody hens may generally be returned to the flock after 3 or 4 days' confinement.

Debeaking and Specking

Debeaking, removing a portion of the beak, or specking with aluminum or plastic vision-control devices, are practices designed to curtail cannibalism. In either instance the practice must not limit feed consumption or production will suffer. If the beak is trimmed too severely this may occur. At least half of the beak should remain. With specks, care must be taken that the layers will have ready access to feed and not get the specs caught in wire or in the various pieces of equipment.

Care of Males

Little attention is paid to the management and feeding of males and they are usually treated similarly to pullets or layers. Research at the Oregon Agricultural Experiment Station has shown that when holding adult males separately they may be fed simplified holding rations containing no more than 9 percent protein and 1 percent calcium without any adverse effect on subsequent reproductive performance. Before mating, males should be exposed to 12 to 14 hours of light 4 to 6 weeks before fertile eggs are required. Males should be checked periodically for body weight, as weight losses of 10 to 15 percent may result in decreasing fertilizing capacity.

Restricted Water Intake

Some birds or flocks have very watery droppings that result in serious management problems. In such situations water consumption is often noticeably increased. When this occurs, this problem can be minimized by restricting layers to 3 or 4 fifteen-minute periods of water intake throughout the day. This can be accomplished by use of time clocks and solenoids, and where continuous-flow waterers are used this would result in significant savings in water use. Should the problem of watery droppings be anticipated, it is desirable to begin such a program with the onset of lay and preferably not when layers are peaking in their rate of lay.

Forced Molting

At times it may be economically advantageous to force-molt layers. This may be done at varying times in the production cycle, usually beginning after 9 months of production. Some producers molt one or more times on a routine basis. Several programs will rapidly curtail production and force a molt. One that has been used involves: 1. Remove or reduce supplemental light (12 hrs/day); 2. Remove all feed and water for up to 3 days; 3. Provide water for 2 hours per day and continue feed removal for 7 more days; 4. Supply feed (a 12-14 percent protein developer diet) and water while feathers return (about 6 weeks); 5. Return lights and layer feed.