Feeding

Laying and Breeding Hens

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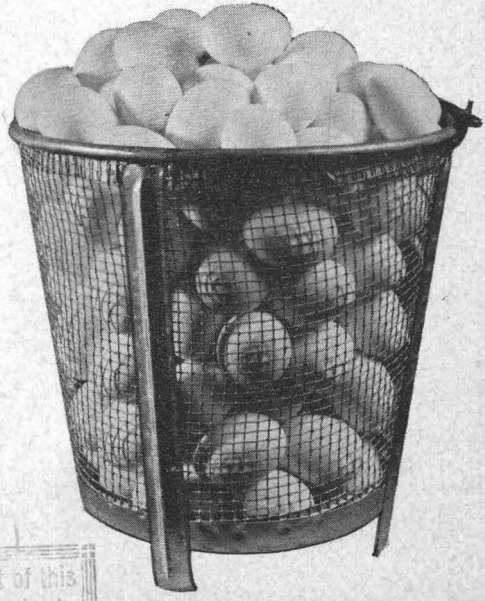

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THE production of eggs for market is a marginal business in which only a relatively small profit per dozen is made by efficient operators. The margin of profit does not provide sufficient leeway to justify the individual poultryman experimenting with feeds or methods of feeding. Until experience warrants, the producer will have better success by accepting proved feed combinations and adhering closely to some definite, approved method of feeding.

Feed represents the largest item of cost 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 artificial deviations from former natural methods have increased the complexity of the problem. Recent findings in poultry nutrition research have not only reduced the 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; namely, proteins, carbohydrates, fats, minerals, vitamins, and water. The proportion of each food nutrient varies in different feeds and the poultryman's aim must be to furnish the correct supply of each for egg manufacture. Only a portion of each nutrient found in poultry feeds is capable of being assimilated by the birds, hence a variation between the actual feeding value and the 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;

Note: This bulletin is revised from and is to supersede Extension Bulletin 633, an earlier work on the same subject.

consequently their feeding value is greater, though the chemical analysis would show them to be the same.

Most grain feeds supply carbohydrates and fats in relatively large amounts but do not contain a large supply of either proteins or minerals. Grains alone do not constitute a balanced ration for egg production since they are deficient in quantity as well as quality of the proteins involved in egg manufacture. They are also deficient in minerals and vitamins. Furthermore, consideration must be given to the incorporation into the ration of ingredients reported to contain unidentified nutrients required for normal egg production and hatchability. To correct these deficiencies the grain feeds must be supplemented with grain byproducts, vegetable and animal protein concentrates, and vitamin and mineral supplements.

Supplements

► PROTEINS. Proteins are one of the highly important classes of nutrients. There are many different proteins and in poultry feeding the source and quality of any protein used must be considered more important than its quantity. Proteins in the process of digestion are broken down into amino acids. 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 must therefore be supplied in the diet. Since most sources of protein will not supply all of the essential amino acids, it is common practice to use combinations of protein-containing materials.

The poultry industry at one time depended on liberal feeding of milk products, meat scraps, and fish meals as major sources of protein concentrates as well as sources of vitamins. Conditions brought about by World War II reversed this situation and forced the industry to depend more on vegetable protein concentrates such as soybean, sesame, pea, cottonseed, and peanut meals. It has been shown, however, that supplementing these vegetable proteins with certain animal protein supplements and vitamins is necessary for optimum egg production, hatchability, and viability of progeny.

► MINERALS. Minerals are one of the six nutrient factors. Unless care is taken that there is a sufficient supply of minerals needed, both egg production and hatchability may decrease. The feeding of minerals is vastly more important under present intensive poultry-keeping conditions than it was under small-flock and free-range conditions.

Grains and their byproducts 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 supplied in sufficient amounts under ordinary conditions.

Oystershell or limestone grit kept before the birds at all times supplies the much needed calcium carbonate for eggshells. Bone meal or defluorinated rock phosphate is fed primarily to supply phosphorus. Iodized salt supplies sodium, chlorine, and iodine and is added to the mash at the rate of 0.5 to 1 per cent of the total mash mixture. Similarly, since manganese has been shown to be required for normal hatchability, this ingredient is supplied by means of several commercial grades of manganese sulfate. Manganese sulfate, as such, is generally included at a level of $\frac{1}{4}$ pound per ton. Care should be taken that these minerals are evenly distributed throughout the mash.

Grit is fed in separate troughs. A hard acid insoluble grit is preferred by many poultrymen because it lasts longer and aids in breaking down feeds high in fiber. Others use soluble limestone grit because, like oystershell, it supplies calcium. In the use of limestone grit, caution must be exercised in avoiding excess magnesium, which is sometimes found in the strata of limestone called dolomites.

▶ VITAMINS. Vitamins are found in natural products and cannot for the most part be synthesized by birds, though they do have the ability to store limited amounts. Of these food factors that play so vital a part in nutrition, several have an important bearing in feeding for egg production and breeding purposes. These are Vitamins A, B_{12}, and D, as well as riboflavin and pantothenic acid. The other vitamins either are present in sufficient quantity in the usual feeds or do not affect poultry.

Vitamin A is supplied in green feed, particularly green leafy vegetation. Yellow corn and some fish oils supply liberal amounts. Commercially prepared sources of Vitamin A are also available; such as for example Vitamin A and D feeding oils and dry stabilized Vitamin A. This vitamin promotes growth and health and is necessary for good production and hatchability. A shortage of this vitamin decreases resistance to diseases, particularly of the respiratory tract and eyes.

Vitamin D is present in ultraviolet light, sunlight, certain fish oils, and some other commercial products. The vitamin strength of oils varies but the Vitamin D does not deteriorate in mixed feeds as rapidly as does Vitamin A. The need for Vitamin D is greater in cloudy, rainy weather or when birds are closely confined in houses not admitting direct sunlight. The presence of Vitamin D promotes better health and stronger eggshells. The lack of it results in poor

utilization of calcium and prosphorus resulting in decreased egg production, faulty bone formation, and leg weakness.

Riboflavin is found most abundantly in dried-liver meals, yeast, dried-milk products, alfalfa-leaf meals, fish meals, and meat scraps. The synthetic product is relatively inexpensive and is also generally available. The presence of this vitamin in suitable amounts in a laying ration not only improves egg production, but is particularly desirable for the production of eggs that are to be saved for hatching purposes.

Pantothenic acid is required both for egg production and normal hatchability as well as growth, viability, and the prevention of dermatitis in chicks. While most rations as formulated are able to supply the requirement for egg production with little difficulty, the requirement for normal hatchability, however, must be considered. Feedstuffs containing this vitamin are: dried liver meal, certain yeast products, dried whey, and alfalfa products. Synthetic vitamin concentrates are also available.

Vitamin B_{12}, one of the most recently crystallized vitamins of the B-complex series, has been shown to be necessary for normal hatchability as well as growth and viability of progeny. It occurs chiefly in animal protein supplements such as fish meal, condensed fish solubles, liver meal, meat scraps, and dried skimmilk. Plant protein supplements, on the other hand, are relatively 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 material is a variable source of Vitamin B_{12} and all breeder rations should contain adequate amounts of this vitamin. The addition of 5 per cent fish meal or meat scraps or 3 per cent condensed fish solubles will meet the breeder hen's nutritive requirement for the vitamin as will several commercially prepared Vitamin B_{12} supplements when fed as recommended.

An unidentified factor necessary for normal hatchability involving hens fed an all-vegetable type ration adequately supplemented with Vitamin B_{12} and other known nutrients has been reported. Although differences in hatchability under practical conditions for the most part are small, it is believed desirable, nevertheless, to include carriers of this unknown nutrient in the ration of the breeder hen. Rations containing 3 per cent condensed fish solubles appear to supply an adequate level of the unknown nutrient in question. While only limited data exist at present as to the sources of this factor, it is felt that certain animal protein supplements such as fish meal or meat scraps may provide an adequate level of this unknown factor.

Uses of feeds

The first use of feed by the hen is for body maintenance. Approximately 65 to 75 per cent of her normal feed intake is used for this purpose. A limited supply of feed, therefore, might be no more than sufficient to maintain body needs. 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 and then cease production. Hence it becomes apparent that it is necessary to keep before her a reasonably constant supply of the essential nutrients in order 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 made up from the nutrients in others. Palatability of feeds is important. Little is gained if, through lack of palatability, the feeds supplied are not consumed in sufficient amounts for heavy production.

Nutritional requirements

Considerable data have been obtained relative to the nutritive requirements of the hen for the production of eggs for commercial and hatching purposes. Table 1 lists recommended levels of protein,

Table 1. RECOMMENDED ALLOWANCES FOR LAYING AND BREEDING HENS

Feed nutrients per pound of mash	Layers		Breeders	
	All-mash	With grain[1]	All-mash	With grain[1]
Total protein, per cent	15-16	20-22	15-16	20-22
Crude fiber,[2] per cent	6	7	6	7
Vitamins				
Vitamin A, I.U. (International Units)	3,300	5,600-6,600	4,000	7,000-8,000
Vitamin D, I.C.U. (International Chick Units)	340	680	350-400	700-800
Riboflavin, milligrams	1-1.2	1.5-1.9	1.4-1.6	2.2-2.5
Pantothenic acid, milligrams	2.5-3	2.5-3	5-6	6-7
Vitamin B_{12}, micrograms	?[3]	?	2-2.5	4-5
Minerals				
Calcium, per cent	2.25[4]	2-2.25[5]	2.25[4]	2-2.25[5]
Phosphorus, per cent				
Total	0.75-1.0	1.2-1.5	0.75-1.0	1.2-1.5
Non phytin[6]	0.4	0.8	0.4	0.8
Salt, iodized,[7] per cent	0.5	1.0	0.5	1.0
Manganese, milligrams	15 ?	30 ?	15-45	30-90

[1] Involves approximately equal parts of grain by weight.
[2] As a general rule, crude fiber should not exceed this value.
[3] Where "?'s" are shown, no requirement has been established. Experience indicates that practical rations generally contain an adequate level of these nutrients.
[4] This level is included if no added calcium supplement is to be fed.
[5] This level can be employed if a calcium supplement is to be fed.
[6] Non phytin phosphorus includes the inorganic phosphorus supplied by bone meal, defluorinated rock phosphate, dicalcium phosphate, fish meal, meat scraps, etc., plus 30 per cent of the organic phosphorus supplied by other ingredients in the ration.
[7] Represents added iodized salt.

vitamins, and minerals to be considered in the formulation of practical layer and breeder rations. Many nutrients are not included since they will always be supplied in adequate amounts in commonly used feed ingredients. In some cases the requirements for these nutrients have not been established.

Feeds for Production

Mash formulas

In formulating rations for egg production or breeding purposes it must be understood that no one formula is best; neither is any particular feed ingredient indispensible in making up a ration. The type of ingredients employed must be dependent on several factors, foremost of which are nutritive content, availability, and price. It should be emphasized that 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 are furnished to insure a sufficient "carry-over" 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. Whenever practical, a breeder ration should be fed 2 to 4 weeks prior to saving eggs for hatching.

Table 2 shows the approximate make-up of laying and breeding rations involving a variety of feed ingredients. Consideration is also given to the "all-mash" type of ration versus the ration supplemented with scratch grains. In the formulation of any ration not only are the requirements cited in Table 1 to be followed, but also information on the nutritive content of the feedstuffs is necessary. Data on the approximate composition of commonly used feedstuffs are shown in Table 7. (See page 19.)

Suggested layer and breeder rations are given in Table 3. Ration No. 1 for both layers and breeders is to be fed without added scratch grains. Rations No. 2 and 3 are to be fed with not more than equal parts by weight of scratch grains. In addition, breeder ration No. 3 is formulated to meet all the known nutritional requirements for breeders, commercial layers, and chicks of all ages. Under normal conditions the cost of the total ration will be materially reduced by providing scratch grains free choice to growing birds in addition to this mash.

Where ample supplies of locally grown grains are available, protein concentrate mashes can be employed. Such rations can be developed from rations No. 2 or 3 (see Table 3) by omitting approximately 900 to 1,000 pounds of the ground grain. The protein

concentrate mash is fed free choice together with a mixture of the locally grown grains. Excessive use of whole grains containing a high fiber content should be avoided.

Table 2. APPROXIMATE MAKE-UP OF RATIONS FOR LAYERS AND BREEDERS

Feed nutrient	Layers		Breeders	
	All-mash	With scratch grain[1]	All-mash	With scratch grain[1]
	Per cent	*Per cent*	*Per cent*	*Per cent*
Grains and grain by-products				
High-energy products (corn, wheat, milo, etc.)	35-60	25-60	35-60	25-60
Medium and low-energy products (barley, oats, middlings, bran, etc.)	0-35	0-35	0-35	0-35
Protein concentrates				
Animal proteins (fish meal, meat scraps, dried skim-milk, etc.)	0-2.5	0-5.0	2.5-5.0	5-7.5
Vegetable proteins (soybean meal, corn gluten meal, peanut meal, etc.)	10-12.5	20-25	7.5-10	15-20
Dehydrated alfalfa meal	2.5-4	5-7.5	2.5-4	5-7.5
Unidentified vitamin carriers[2]				
Dried whey products, fermentation solubles, dried distillers' solubles, dried brewers' yeast, etc.			2.5-4	5-7.5
Other vitamin supplements[3]				
Vitamin A (Vitamin A oils, dry stabilized Vitamin A)				
Vitamin D (Vitamin D oils, "D" activated animal sterols)				
Riboflavin				
Vitamin B_{12}				
Pantothenic acid				
Mineral supplements				
Calcium carriers (limestone, oyster shell flour etc.)[4]	3-4	3-5	3-4	3-5
Phosphorus and calcium carriers (bone meal, defluorinated rock phosphate, etc.)	2-2.5	3-4.5	1.5-2	2.5-4
Salt, iodized	0.5	1	0.5	1
Manganese sulfate, 65 per cent	0.015	0.025	0.025	0.025

[1] Involves approximately equal parts of scratch grain by weight.
[2] Unidentified nutrients are also supplied by protein concentrates of animal origin.
[3] To be added when other feedstuffs in the ration do not meet the requirements given in Table 1.
[4] The entire amount of calcium carrier need not be added in the mash provided that oyster shell or some other suitable calcium source is fed free choice.

Table 3. SUGGESTED LAYER AND BREEDER RATIONS

Ingredient	Laying mash mixtures		Breeder mash mixtures		
	No. 1 (all mash)	No. 2 (with grain)[1]	No. 1 (all mash)	No. 2 (with grain)[1]	No 3 (with grain)[2]
Ingredients	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Wheat, mixed feed	340	200	200	100	300
Wheat, ground, Pacific Coast	200	100	300	100	300
Corn, ground	768	734	658	564	420
Oats, ground, Pacific Coast	100	50	100	50	300
Barley, ground, Pacific Coast	200	100	200	100	.....
Alfalfa meal, dehydrated, 17 per cent	60	120	80	160	100
Soybean meal, solvent 46 per cent	200	430	220	440	200
Meat meal, 60 per cent	50	100	20	40	100
Fish meal, 70 per cent	.....	.....	50	100	100
Whey, dried	.....	.....	80	160	50
Distillers' dried solubles	.....	.....	.....	.....	50
Oyster shell flour[3]	30	60	40	80	20
Steamed bone meal	40	80	40	80	40
Salt, iodized	10	20	10	20	10
Vitamin A & D feeding oil (2,250 I.U. Vitamin A; 300, I.C.U. Vitamin D/gm.)	1.5	6	2	7	10
"D" Supplement (1,500 I.C.U./gram)	.8	.8	.8	.8	.4
Manganese sulfate, 65 per cent	.3	.4	.3	.6	.4
Riboflavin, synthetic or equivalent[4]	.5 gm.	1 gm.	.....	.....	2 gm.
Vitamin B_{12}, synthetic or equivalent[4]	.....	.....	1 mg.	2 mg.	2 mg.
Total ingredients[5]	2,000.6	2,001.2	2,001.1	2,002.4	2,000.8
Calculated analysis (units indicated)					
Protein, per cent	15.1	20.1	16.2	21.9	20.5
Fiber, per cent	5.0	5.2	5.0	5.7	5.9
Calcium, per cent	1.2	2.8	1.5	2.9	1.7
Phosphorus, per cent					
Total	.8	1.4	.76	1.2	1.0
Non phytin	.5	.9	.5	.9	.8
Vitamin A, I.U./pound	3,560	7,474[6]	4,120	8,990[6]	8,552[6]
Vitamin D, I.C.U./pound	374	681	408	748	815
Riboflavin, milligrams/pound	1.3	1.7	1.5	2.4	2.7
Pantothenic acid, milligrams/pound	4.7	4.6	5.2	6.0	5.8
Vitamin B_{12}, micrograms/pound	.9	1.9	4.6	9.2	10.3
Manganese, milligrams/pound	26	25	24	31	32

[1] Involves approximately equal parts scratch grain by weight.
[2] All purpose laying, breeder, and chick ration. When used as chick starter grain feeding is limited.
[3] "Free choice" feeding of calcium carrier is required for layers and breeders.
[4] Not included in total weights, but adding these ingredients as they are called for is important to nutritional value of mash.
[5] Quantities were calculated to approximate 1 ton when combined.
[6] Includes total Vitamin A supplied in the mash portion of ration. An adequate level of Vitamin A is present independent of that contained in corn in the mash or scratch mixture.

Scratch grains

Oregon produces a surplus of high-quality wheat, oats, and barley, and a generous use of these home-grown feeds should be made where economically feasible. Oregon's corn production has not equalled our use. A heavy tonnage of corn is shipped into the state despite high transportation costs.

Wheat is one of the best poultry grains. It is generally available in all parts of the state. It is high in carbohydrates and low in fiber and minerals. It may entirely replace yellow corn if the Vitamin A content of the corn is supplied from some other source.

Heavy, thin-hulled oats have a high feed value. They are not as palatable as wheat or corn, probably because of their higher fiber content. Oats normally should not be used in excess of 25 per cent of the scratch grain by weight.

Barley, another source of energy, contains less fiber than oats. It may be substituted for oats or wheat or replace 50 to 100 per cent of the corn but normally should not constitute more than 50 per cent 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 make a sudden incorporation of it in the ration. Poultrymen generally prefer Hannchen barley for feeding whole because the objectionable awns are knocked off in threshing. Some of the more heavily bearded varieties may be rolled before feeding.

Yellow corn is palatable and furnishes carbohydrates efficiently. It is a good source of Vitamin A. Kafir, milo, buckwheat, and other less common grains are not generally available in Oregon in sufficient tonnage to make them economical feeds, though when available at reasonable prices they are satisfactory.

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 grains should be used in the scratch mixture. Three suggested scratch mixtures for laying and breeder hens are listed in Table 4 and the selection or variation of any one of them may depend on local conditions.

Table 4. SUGGESTED SCRATCH MIXTURES FOR LAYING AND BREEDING HENS

Ingredient	No. 1	No. 2	No. 3
	Pounds	*Pounds*	*Pounds*
Barley	.....	300	1,000
Corn	1,000	300	500
Oats	500	400	.....
Wheat	500	1,000	500
Total	2,000	2,000	2,000

Green feed

Green feed is a source of vitamins and perhaps certain unidentified and unrecognized nutrients. Wherever succulent green feed

can be provided it may be fed as an additional safeguard. Ladino clover, alfalfa, and kale supplemented with green oats, vetch, or other winter greens in the early spring provide a continuous green feed supply throughout the year west of the Cascade Range. Green and dry alfalfa supply the basic green feed needs of other areas in Oregon.

Each 100 birds should not receive more than 4 to 5 pounds of succulent green feed daily in addition to the dried greens incorporated in the mash.

Mangel beets and carrots, while not strictly green feeds, do supply succulence, help to keep the birds occupied, and tend to prevent such vices as feather picking and cannibalism. Carrots are high in Vitamin A content and unlike green vegetation, do not supply the pigment that causes dark-colored yolks.

Overfeeding of greens and succulents may have harmful results. These feeds are bulky and take up space which may reduce the amounts of more nutritious mash and grains consumed.

Effects of feeds on internal egg quality

Excessive feeding of highly pigmented feeds such as kale, rape, rye pasture, yellow corn, and certain weeds like shepherd's purse, mustard, and penny cress will give an undesirable deep color to the egg yolk. 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. The excessive feeding of onions, fish, and fish oils may give the eggs an undesirable flavor.

Water

Because both the fowl's body and the egg are high in water content a good supply of water is imperative. An egg contains approximately 67 per cent water. One hundred laying hens will require 5 to 6 gallons of water per day.

Milk

Milk contains highly digestible proteins, minerals, and valuable vitamins. Liquid skimmilk or buttermilk contains about 10 per cent solids, condensed buttermilk about 30 per cent, and dried milk about 90 per cent. On this basis 1 pound of dried milk is equivalent to approximately 3 pounds of semisolid or 9 pounds of fresh skimmilk; the relative economy is determined largely by the price. The choice of milk products will depend on the available supply.

Feeding Practices

Use of scratch grains

Scratch grains can be fed in two ways—either by feeding all of it in the late afternoon or by feeding approximately a third of it in the morning and the remainder in the afternoon. Because of the labor involved most poultrymen prefer to feed scratch grains only in the afternoon. Scratch grains are 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.

As previously noted, scratch grains should constitute not more than 50 per cent of the ration by weight. The overfeeding of grain will result in a decreased consumption of mash and an inevitable drop in egg production. Daily consumption of 100 White Leghorn hens will be approximately 10 to 15 pounds of grain.

The tentative daily feed requirement per 100 layers based on body size and rate of production is given in Table 5. Thus it can

Table 5. 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 per cent of lay				
	0 per cent	20 per cent	40 per cent	60 per cent	80 per cent
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
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, University of Maryland, 1941*

be seen for example that 100 birds averaging 4 pounds in weight and laying 60 eggs daily will consume approximately 24 pounds of feed per day.

Constant supply of mash advised

Dry mash should be available in mash troughs at all times. The mash trough used at Oregon State College holds only a few days' supply, necessitating frequent fillings and thereby insuring a fresh supply of mash and the opportunity to check on its consumption.

Economical use of mash is influenced by the amount of mash trough space provided. Insufficient trough space promotes crowding and reduces consumption of feed. A minimum of 25 lineal feet of trough or hopper space should be available for each 100 hens. Research results indicate that hens will lay a little better when

32 feet per 100 layers are available. A regular trough 8 feet long with feeding space on both sides provides 16 lineal feet of hopper space. Two such troughs would be ample for 100 hens.

Leghorn layers that consume a total of from 25 to 30 pounds of feed per day should receive at least 13 to 15 pounds of mash daily. Heavy breeds may eat more feed and require more mash.

Under ordinary conditions scratch grains should not be fed to layers receiving an all-mash ration.

Supplemental feeding

Occasionally it is necessary to vary the routine method of feeding. Supplementing more appetizing feeds to increase the fowls' intake of food 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.

- Mash moistened with water or milk is an excellent supplemental feed. It should be given in an amount that the hens will consume eagerly in 20 minutes, usually about 2 pounds of mash per 100 birds. Moist mash may be fed in the middle of the day or after the evening grain feed.
- Two pounds of pellets fed daily to each one hundred hens being fed mash and grain is an excellent emergency or seasonal supplemental feed.
- Liquid milk or condensed or concentrated milk products are often fed to stimulate feed consumption.
- Any one of the supplemental feeds used may be gradually discontinued when the desired results from its use have been obtained.

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. A general recommendation, however, is to house pullets by the time they reach 10 to 15 per cent egg production.

Replacement pullets may be changed from the developer mash to the layer or breeder mash either shortly before or after they are housed. It is not a good practice to change the feed at the same time that the pullets are housed. Always make as few major changes at one time as is practical.

Range reared pullets may be fed some green feed for a few weeks after they are housed. This practice makes the change from range to confinement less abrupt and may aid in reducing feather picking and cannibalism.

To encourage feed intake for the first few days after housing it is advisable that feed be readily available. A few extra troughs of feed placed on the floor will help to 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 change-over.

Figure 1. Nests are provided for pullets on range before they are moved into laying house.

Physical and sexual maturity important

Pullets should be housed according to their physical and sexual maturity. Any normal flock of pullets of the same age will mature in three groups: first, the early maturing individuals; second, the greater number or average of the flock; and third, the slower maturing ones. To house these three grades of pullets at the same time and in the same room frequently is an expensive mistake.

Range houses should be equipped with a few nests for those pullets that lay before being moved into permanent houses. 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.

Feeding Breeding Hens

As previously noted, a more complete ration is required to meet the needs of hens producing hatching eggs than for the flocks fed only for the production of commercial eggs. Ordinary egg mash does not always meet the needs of the breeding flock. Commercial egg production can be obtained on rations cheaper in cost than breeder mashes.

In earlier years most of the chicks were hatched under hens or in small incubators on the farms. The rapid trend toward hatchery expansion and centralization has created a greater need for better feeding of breeding flocks. Under present day practices of mass production chicks are hatched at all seasons of the year. The former conditions of small flocks having access to succulent green ranges, sunshine, and spring conditions must be duplicated today by better rations.

Breeder hens require greater amounts of Vitamins A and B_{12}, riboflavin, and pantothenic acid than do laying hens fed for market egg production. Similarly it has been shown that breeder hens require greater amounts of manganese than do commercial layers. A definite reduction in hatchability of eggs occurs on a ration deficient in manganese.

Flock owners must provide breeder rations that will meet the requirements for body maintenance of the hen, supply the necessary nutrients for the production of eggs, and furnish all the essential nutrients in such liberal amounts that enough of some of them can be carried over into the hatching eggs to meet the demands of the growing embryos. In addition, sufficient quantities of these nutrients, especially the vitamins, must be available in the yolk for normal viability and growth of the newly hatched chick.

Effect of breeder ration on chicks

The specialized poultry breeder or hatcheryman cannot afford to incubate eggs from flocks that have not been fed a ration supplying all the necessary nutrients for maximum hatchability and livability of the chicks.

The chick-buying public cannot afford to invest money in chicks that show reduced growth or livability and develop at an early age such troubles as dermatitis, paralysis of the toes, and perosis because of deficiencies in the diet of the parent stock.

The mere fact that a flock maintains high egg production on an egg mash is no evidence that high hatchability or strong chicks will result.

Cages for Laying Hens

Feeding layers in cages

While most commercial layer and breeder flocks are kept in conventional type poultry houses with litter on the floor, some poultrymen keep laying hens in individual cages of the inside or outside type while others prefer to house their birds in community cages in groups of from 15 to 30 birds per cage. Since birds in wire cages receive no additional nutrients from poultry house litter, soil or pasture, the ration fed must be complete and balanced with respect to the required nutrients or the results are certain to be unsatisfactory.

Results over a 13 year period at the Oregon Agricultural Experiment Station have shown that layers in cages of either the inside or outside type can be fed the same rations as those recommended for regular flocks on litter. It has also been shown that layers in cages will lay just as well on an all-mash ration as on a mash and scratch grain ration, as shown in Table 6.

In cage set-ups equipped with mechanical feeders the use of an all-mash ration is desirable. In some cases oyster shell 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.

Where mash and grain are fed, the birds should be given one daily feeding of grain. The grain can be fed on top of the mash. In addition to the mash and grain feeds the birds should have free access to insoluble grit, oystershell, and fresh water.

In general cages are not recommended for breeding hens.

Table 6. COMPARATIVE VALUES OF ALL-MASH AND MASH-SCRATCH RATIONS FOR WHITE LEGHORN PULLETS IN OUTDOOR-TYPE INDIVIDUAL CAGES

Year	Egg production percentage		Total feed per dozen eggs	
	All-mash ration	Mash-scratch ration	All-mash ration	Mash-scratch ration
	Per cent	*Per cent*	*Per cent*	*Per cent*
1949-50	56.2	61.6	6.6	5.9
1950-51	54.4	51.2	6.1	6.5
1951-52	53.7	52.6	5.9	5.4
Average	54.8	54.7	6.2	5.9

Data from Oregon Agricultural Experiment Station

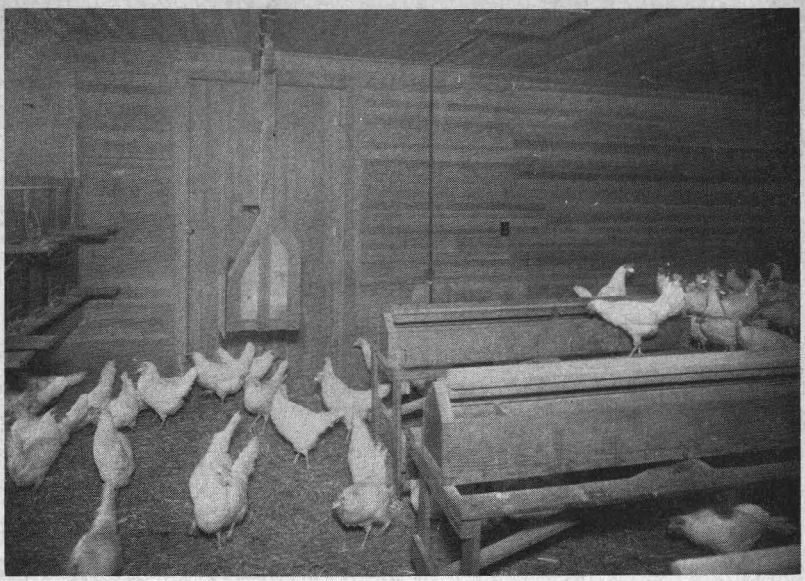

Figure 2. Floor pen checks against laying cages.

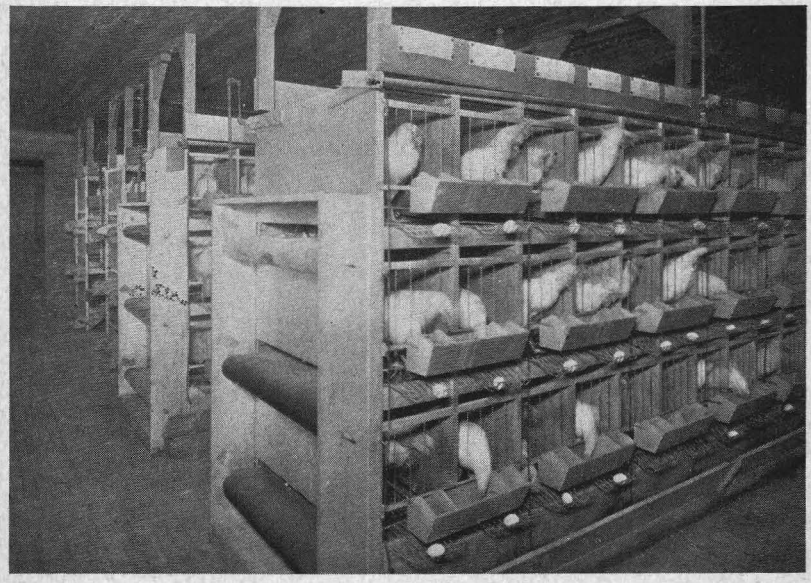

Figure 3. OSC individual indoor laying cages.

Table 7. Approximate Composition of Certain Commonly Used Feedstuffs[1]

Feedstuffs	Protein	Fiber	Calcium	Phosphorus	Manganese	Vitamin A activity[2]	Riboflavin	Pantothenic acid
	Per cent	*Per cent*	*Per cent*	*Per cent*	*Milligrams/pound*	*I.U./pound*	*Milligrams/pound*	*Milligrams/pound*
Alfalfa meal, sun cured, 17 per cent protein	17.6	23.8	1.31[3]	0.17[3]	.....	40,000	8.8	.....
Alfalfa meal, dehydrated, 17 per cent protein	17.8	24.2	1.70	0.22	15.0	60,000	7.3	12.3
Alfalfa meal, sun-cured, 20 per cent protein	20.3	17.8	.....	.....	.....	80,000	7.2	.....
Alfalfa meal, dehydrated, 20 per cent protein	20.9	19.8	1.66	0.31	28.6	100,000	7.4	18.5
Barley, Pacific Coast	9.7	6.2	0.06	0.41	7.8	.....	0.6	3.3
Bone meal, steamed special	13.4	1.1	29.30	15.10	5.1	.....	0.4	0.8
Brewers' dried yeast	46.8	2.8	0.11	1.52	2.4	.....	14.0	49.1
Buttermilk, dried	32.4	0.3	1.35	0.94	1.5	.....	15.8	13.5
Corn, dent, yellow	8.9	2.0	0.023	0.27	2.3	2,210	0.5	2.6
Corn, gluten meal, 41 per cent protein	42.9	3.9	0.20	0.41	4.4	16,000	0.7	3.8
Cottonseed meal, 41 per cent protein	41.2	11.2	0.18	1.14	12.9	.....	2.5	4.4
Distillers' solubles, dried	28.0	3.3	0.35	1.40	45.4	.....	5.2	8.9
Fish meal, herring[3]	69.6	1.2	4.2	2.8	.....	.....	3.0[4]	3.0[4]
Fish meal, menhadden	62.2	0.7	5.0	3.40	10.0	.....	2.4	3.5[4]
Fish meal, sardine	67.2	0.6	4.21	2.54	10.3	.....	2.5	3.0[4]
Limestone	.....	.....	38.30	.....	.....	.....	.....	.....
Meat scrap, 52 per cent protein	52.9	2.2	8.7	4.40	4.0	.....	2.4	2.1
Meat scrap, 60 per cent protein	60.9	2.4	6.3	3.50	5.4	.....	2.5	2.3
Oats, Pacific Coast	9.0	11.0	0.09[3]	0.35[3]	19.0[4]	.....	0.4[4]	6.8[4]
Oyster shell, ground	.....	.....	37.9	.....	.....	.....	.....	.....
Peanut oil meal, o.p., 43 per cent protein	43.1	13.9	0.16	0.54	.....	.....	2.4	24.1
Phosphate, defluorinated rock	.....	.....	28.3	12.3	40.9	.....	.....	.....
Skim milk, dried	34.7	0.2	1.27	1.10	1.2	.....	10.0	16.0
Soybean oil meal, 44 per cent protein	44.2	5.6	0.30	0.66	14.0	.....	2.0	6.1
Soybean oil meal, solvent, ext.	46.1	5.9	0.29	0.63	13.8	.....	1.4	6.2
Wheat, soft, Pacific Coast	9.9	2.7	0.05[4]	0.29	27.7	.....	0.5	5.2
Wheat, bran	16.4	9.9	0.14	1.30	56.0	.....	1.4	13.6
Wheat flour middlings	18.1	4.9	0.07	0.65	39.0	.....	0.8	4.5
Wheat, mixed feed, (mill run)[3]	15.5	8.5	0.1	1.0	45.0[4]	.....	1.0[4]	8.0[4]
Wheat, standard middlings	17.6	6.7	0.14	0.78	53.6	.....	0.8	9.3
Whey, dried	12.2	0.2	0.91	0.75	1.1	.....	13.0	22.4

[1] Unless otherwise indicated this table is based on data prepared by the committee on Feed Composition. National Research Council.
[2] Rough approximations since carotene content is too variable for dependable averages.
[3] Oregon analyses: Jones, I. R., and R. W. Morse, 1949. Feeding for Milk Production. Oregon Agricultural Experiment Station Bulletin 464.
[4] Estimated values.

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