EXTENSION BULLETIN 51 APRIL 1939

Feeding for EGG PRODUCTION

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MICHIGAN STATE COLLEGE :: EXTENSION DIVISION
EAST LANSING

Cooperative Extension Work in Agriculture and Home Economics, Extension Service, Michigan State College and the U. S. Department of Agriculture Cooperating

FEEDING AND MANAGEMENT for EGG PRODUCTION . . .

1. Keep clean water before birds at all times. Keep temperature uniform in cold weather. Allow plenty of water space.
2. Keep feed available at all times. Use plenty of feeding space, particularly if grain is fed continuously.
3. Do not crowd the birds. Allow 3½ to 4 square feet floor space per bird. Allow sufficient ventilation. 10 inches roosting space per bird.
4. Keep litter clean.
5. Keep nesting material clean.
6. Use regular lighting system.
7. Keep the birds free from lice and mites.
8. Use wet mashes carefully.

PRODUCE GOOD EGGS . . .

1. Feed a uniform ration.
2. Keep house and nests clean.
3. Gather eggs frequently and put them in a cool place.
4. Cool properly before packing.
5. Store in temperatures of 60 degrees or less.
6. Market frequently.
7. If sold direct to consumer, candle and grade.

FEEDING *for* EGG PRODUCTION

J. A. DAVIDSON

POULTRY is one of the leading sources of farm income in Michigan. The production of eggs is the principal factor in respect to this income, meat production being primarily a by-product. Feeding practices are essentially similar, either for the production of eggs or meat, differing only in the proportion of the various nutrients. This bulletin, however, is not intended to be a text book on poultry nutrition. It will, therefore, be limited as much as possible to one phase of poultry, namely, feeding for egg production.

FACTORS AFFECTING EGG PRODUCTION

Efficiency of production should be the aim of each producer, even though total production may be reduced. Increased production per hen is a practical method of increasing efficiency.

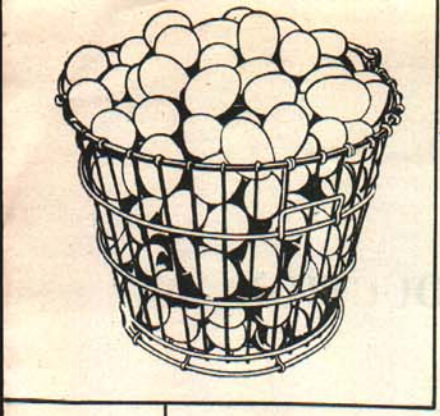
At least four important factors are involved in the problem of obtaining the greatest egg yields. They are, breeding, housing, disease control and feeding. It is not our purpose to cover the first three factors. Proper feeding cannot be expected to overcome poor breeding and improper selection. Proper feeding cannot offset the failure to adequately and comfortably house the flock and the use of practical and economical means of controlling common poultry diseases and parasites.

NATURE OF THE HEN

The hen may be compared to a factory. Feeding is the method of supplying the raw material (feedstuffs) to the factory (hen) which produces the manufactured product (eggs).

The following should be remembered in respect to the hen.

(1) Hens are fed as a flock rather than individuals.
(2) Compared to a dairy cow, the hen has a higher body temperature and greater activity.
(3) A hen consumes in proportion to her weight twice as much dry matter as a dairy cow.
(4) The digestive system is short and comparatively simple. The capacity is small and, therefore, coarse and bulky feeds cannot be used in a great extent.



NECESSITY FOR FOOD

Food is supplied for two main purposes: (1) building material for construction of new tissues and their products. (2) source of heat and energy. During the period of egg production the replacement of tissue and the formation of the egg must be rapid. The production of an egg is a reproductive process and therefore, it is important that this replacement be given every chance to be steady and complete. Energy for the production of heat necessary for maintaining the body temperature and for all body activities including locomotion, blood circulation, respiration, digestion, absorption, and excretion must be supplied.

A constant supply of food is necessary. If the supply fails, the birds will lose weight, living on and consuming their own body material until death occurs. If the supply exceeds the demand, the body may store the excess as a reserve for time when food is less plentiful.

PRINCIPLES OF FEEDING

Food is composed of several different groups of substances called nutrients. A **nutrient** is a term applied to any food constituent or group of food constituents of the same general chemical composition that aid in the support of animal life. Six groups are recognized: proteins, carbohydrates, fats, water, vitamins, and minerals. Most of these cannot be used in the form supplied. They must undergo a digestive process, breaking down into their simplest and most soluble forms so that they can pass through the intestinal wall, be absorbed by the blood, and distributed throughout the body.

PROTEINS

Protein is the name applied to a group of organic compounds which contain principally carbon, hydrogen, oxygen, and nitrogen. The value of proteins is determined chiefly by feeding tests; the chemical analysis is not sufficient owing to the fact that it does not give any information concerning the essential amino acids that the proteins contain. The essential amino acids must be supplied although the bird can build some of the necessary parts. In order to insure an adequate supply of the amino acids, it is important to supply protein from different sources. Excess protein may be used for heat and energy purposes. This generally is an expensive procedure, but sufficient quantities should be available since the bird can not produce an adequate supply from other sources.

PROTEIN FEEDSTUFFS

The protein feedstuffs commonly fed to poultry are by-products of animal and vegetable origin. Animal protein concentrates include milk, meat scrap, tankage and fish meal. Vegetable protein concentrates include soybean oil meal, corn gluten meal, cottonseed meal, and linseed oil meal. The animal protein feedstuffs of good quality are more palatable, more digestible and more easily utilized than the vegetable protein feedstuffs. Combinations of animal and vegetable feedstuffs can supplement each other satisfactorily. Mineral additions are necessary where vegetable proteins are used.

Liquid Skimmilk and Buttermilk have about the same feeding value, provided they have not been diluted with water. The relative feeding value of liquid milk to semi-solid buttermilk or dried milk is as follows: 1 gallon = 3 pounds semi-solid = 0.9 pound dried milk.

Dried Skimmilk and Buttermilk are just as valuable as dried whole milk since the vitamin A found in cream may be supplied from other sources. Choose dried skimmilk creamy white in color with 30 to 32% protein.

Condensed Skimmilk and Buttermilk are of equal feeding value. It is valuable when plenty of scratch grain is fed.

Meat Scrap is a ground, dry, rendered residue from animal tissues exclusive of hoof, horn, manure, and stomach contents, except such traces as might unavoidably occur in good factory practice. If there is more than 10% phosphoric acid, it should be called meat and bone scrap. Good quality meat scrap should be low in fat and free from foreign material. Most meat scraps carry about 50% protein.

Tankage in most cases is inferior to meat scraps for poultry. This is due to the method of manufacturing and the material used. The product is highly variable and, unless dry rendered, gives off considerable odor.

Fish Meal is the clean, dried, ground tissue of undecomposed fish, with or without extraction of part of the oil and contains not more than 3% salt. Fish meals vary in feeding value depending on the kind of fish, method of manufacture and the amount of internal organs the products contain. For instance, vacuum or steam-dried white fish meal is superior to flame-dried white fish meal. Good fish meal should run higher in protein than meat scraps.

Soybean Oil Meal, properly cooked, is satisfactory when supplemented with mineral as a poultry feedstuff. It is made from the soybean remaining after the extraction of the oil. It contains about 43% protein.

Corn Gluten Meal is that part of shelled corn that remains after the separation of the greater part of the starch, the germ, and the bran by the process employed in the manufacture of cornstarch and glucose. When used with sufficient animal protein concentrate it produces good results.

Cottonseed Meal is the product of cotton seed, cleaned of lint and composed chiefly of the kernel with such portion of the hull as is necessary in the manufacture of oil. The protein content of good meal is 40%. With animal protein and supplemented with minerals it can replace part of the animal protein feedstuffs. The use of 5% or more produces poor quality eggs for storage purposes.

Linseed Meal (oil meal) is made from flaxseed after extraction of the oil. It has a laxative action and should not be used to exceed 5% of the ration. Recent work has indicated that the old idea that linseed meal aids in hastening the molt is questionable.

CARBOHYDRATES

Carbohydrates are composed of carbon, hydrogen, and oxygen. They are used for the production of heat and energy and may also be used for the production of fat.

Some carbohydrates are easily digested and therefore have high feeding values. Other carbohydrates form the woody fiber of plants and are difficult to digest. These have a low value for animals.

Fiber of a feed influences the value of a feed because of its effect upon the digestibility. Fiber consists chiefly of cellulose, and is the portion remaining after a feedstuff is treated with a weak acid and alkali. This residue contains the mineral matter and is burned to determine the mineral content. The difference determines the amount of fiber in the feedstuff.

Nitrogen-free Extract includes the more soluble and more valuable carbohydrates. Starches and sugars are the most valuable part of these carbohydrates.

CARBOHYDRATE FEEDSTUFFS

Carbohydrate feed stuffs are used for heat, energy, and fat production. (They contain other nutrients of course.) They are readily available and usually the cheapest feeds. The cereal grains are the chief source of carbohydrates. The amount of different grains in rations may be varied within wide limits, depending on price and availability.

Barley is available in certain sections of Michigan. Corn or wheat in the ration may be replaced by barley with satisfactory results. When barley replaces the corn, additional

sources of vitamin A are required. Birds raised on other grains may not eat barley readily, so that it may have to be used only as a constituent of the mash. The heavier the barley, the higher the feed value.

Corn is generally more plentiful and cheaper than other grains. Yellow corn is preferable to white corn owing to the greater vitamin A content. White corn can be used if supplemented with a high vitamin A supplement. New corn may be used as soon as it is dry enough to shell; however, old corn is preferable, especially in ground feeds. When ground corn is used it should be freshly ground in order to maintain the vitamin A content at a high level, and to maintain the palatability of the feed.

Cracking or grinding corn for poultry after the birds are old enough to eat whole grain is probably not worth the expense and labor involved. There are several by-products of corn such as corn feed meal and hominy meal. Only a small amount of this material is usually available and the composition is variable.

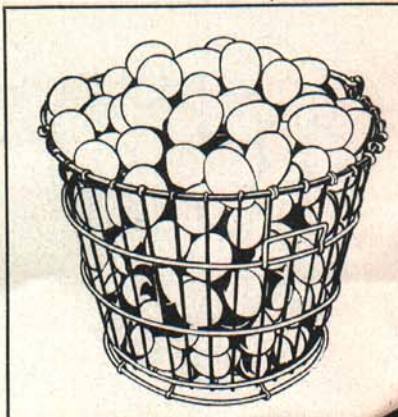
Oats is desirable for poultry. Heavy oats (32 pounds and more per bushel) should be used. The whole oats is preferable for laying hens since the hull has some value. The amount should not be high, owing to the low feeding value, compared with corn.

Wheat is the best liked grain. Ground wheat may be used to replace the bran and middlings in the ration, although the wheat is not so desirable. The bran and middlings have a greater feeding value because they contain the germ and outer coating of the grain and therefore much of the vitamin, mineral and protein content.

Wheat Bran is the coarse, outer coating of the wheat kernel separated in the flour milling process. Flaky bran is preferable to finely ground bran. Bran should not constitute more than 20% of the ration because of its bulk.

Standard Middlings consist of fine particles of bran, germ and some fiber obtained in the milling process. Good middlings are low in crude fiber with little or no screenings. Not more than 20% should be used in the ration as it is gummy when moistened.

Flour Middlings consist of standard middlings and "red dog" flour combined in the proportions obtained in milling. The fiber content should be low.



Rye is not well liked by poultry. It can be used in the mash to replace a small part of the other grains.

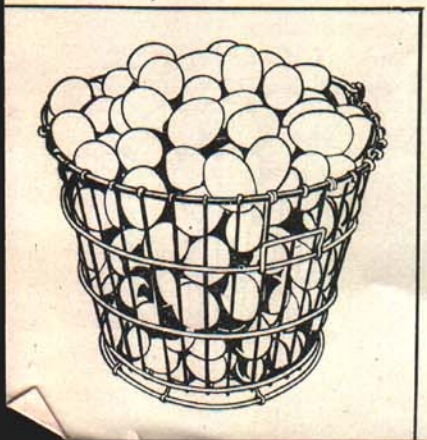
VITAMINS

Vitamins or vitamin forming substances are complex, organic compounds consisting of various combinations and proportions of carbon, hydrogen, oxygen, and nitrogen and possibly other elements. They are necessary for health, maintenance, growth egg production and hatchability. They occur in small quantities in many feedstuffs. The vitamin content of feedstuffs are usually determined by experimental feeding tests.

At present, six vitamins are known, while other vitamin-like substances are being investigated.

Vitamin A is necessary for growth; is essential for normal reproduction; maintains normal functioning of the nervous tissue and the lining of the intestinal tract and respiratory tract thus protecting against infections. A deficiency results in decreased production and hatchability; failure of appetite and digestion; nerve degeneration; nutritional coup and lowered resistance against infections. Vitamin A is closely related to the yellow plant pigment, carotene. It is present in the green parts of plants and in certain yellow parts of plants such as yellow corn and yellow carrots. Birds may manufacture vitamin A from carotene found in feedstuffs or obtain it already formed when fed certain fish oils. The amount of vitamin A stored in the egg yolk depends on the amount of carotene or vitamin A in the ration.

Vitamin B, sometimes called B_1, is necessary for appetite; digestion; normal movements of the intestine; internal secretions; maintenance of normal weight and vigor and prevention of the nerve disease, polyneuritis. It is widely distributed in feedstuffs. The use of yeast which is high in B is questionable with most normal feed formulas, especially when there is plenty of whole cereal grains.



Vitamin C protects from a disease known as scurvy. It is not necessary in poultry rations. Fowls apparently are able to manufacture vitamin C from nutrients in the feed.

Vitamin D is necessary for mineral assimilation. A deficiency decreases egg production, causes thin egg shells and poor hatchability. Certain fish oils contain large amounts of vitamin D. Exposure to direct sunlight enables the fowl to make its own vitamin D.

Vitamin E is essential for hatchability. Usually a normal ration contains sufficient amounts of this vitamin. A deficiency results in low fertility or high early embryo mortality.

Vitamin G sometimes called B_2, is a complex substance which is essential for growth and hatchability. It is divided into riboflavin and the filtrate factor. It is present in grasses, glandular tissue, milk, yeast and some other feedstuffs.

VITAMIN FEEDSTUFFS

Some feedstuffs are included principally for the vitamins they contain.

Green grass is the source of vitamins A, B, E and G. The young, green and tender plants contain more vitamins than the more mature plants.

Alfalfa and other legume hays are substitutes for green grass. Dehydrated hays contain more carotene than sun dried.

Alfalfa Leaf Meal is of more value than alfalfa meal since the vitamin content is about double, the protein content higher and the fiber lower. The alfalfa should have a rich green color.

Fish Oils—cod, sardine, halibut and some other fish oils—are good sources of vitamin A and D. Vitamin A is usually supplied by yellow corn, grass or legume hay but for laying rations additional amounts may be required. Therefore, a fish oil high in vitamin A as well as vitamin D is desirable.

When birds are given free range sufficient vitamin D may be supplied by sunshine. Fish oils are substitutes for sunshine and should be included in rations, for confined birds and breeders during the winter months. The amount used should vary with the potency of the product.

The small amount of sunshine received in Michigan during the fall and winter months means that vitamin D must be supplied. During exceptionally cold weather it may be added to the grain if the birds are taking an unusual amount.

The units given should be based on tests with chicks as vitamin D substances do not always produce the same results on other animals. The fish oil may be mixed with a portion of the bran or ground corn and incorporated in the balance of the mash mixture.

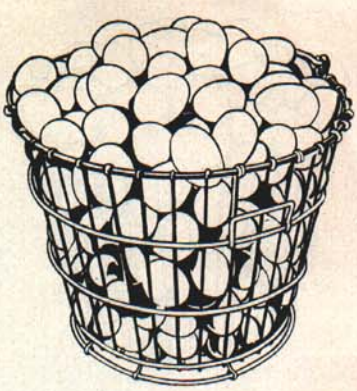
Yeast is a source of vitamins B and G. These are supplied in the usual ration and the addition of yeast is not necessary except in special rations.

Vitamin combinations and preparations are frequently found on the market. Their value depends on the quantity they contain and the ration being used.

50 lb. S. & S. C.—C. P.

Fig. 1. A simple economical plan for warming water.

Fig. 2. Such a water container is easily cleaned.



Dried Whey Powder contains vitamin G. Perhaps it should be listed as a protein carrier but the protein content is low. Dried whey powder usually contains 1½ times as much vitamin G as dried skimmilk when produced under similar conditions.

QUANTITIES OF FISH OILS OF VARIOUS VITAMIN D POTENCIES REQUIRED IN LAYING RATIONS

(Data condensed from Pa. Sta. Bul. 334 and other sources)

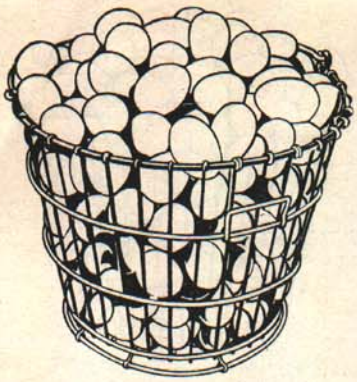
	Vitamin D Potency of Oil (U. S. P. units per gram of oil)	Approximate Percentage of Oil to be Added to the Mash
All-mash Ration	85	1%
	310	1/3%
	400	1/4%
Grain and Mash—Equal Parts	85	2%
	310	2/3%
	400	1/2%
Grain (2–3 Parts)—Mash (1 Part)	85	3%
	310	1%
	400	3/4%

FATS

Fats are composed of carbon, hydrogen and oxygen. There is more carbon in proportion to oxygen in fats than in carbohydrates. They liberate about 2.25 times as much heat as the same amount of carbohydrates. They serve as a reserve supply of heat and energy. Fats are manufactured efficiently by animals from the cheaper and more abundant carbohydrates. Fats are digested with difficulty and absorbed slowly so that large amounts of fat should be avoided in poultry feeding.

WATER

Water is highly important. The bird's body is composed of from 55% to 75% water, which also constitutes more than



65% of the whole egg. It controls body temperature through evaporation in the respiratory system. It is used with and is a necessary part of all the body processes. An adequate supply of clean water of a uniform temperature is necessary.

MINERALS

The mineral elements required in poultry feeding are calcium, phosphorus, sodium, potassium, sulphur, chlorine, iodine, magnesium, iron, manganese, and copper. Calcium and phosphorus are needed for bone formation, calcium for shell formation. Sodium is necessary for the elimination of excess potassium contained in the feed. Chlorides of sodium and potassium are needed for body fluids and tissues. Iodine is required in small quantities for proper functioning of the thyroid gland. Iron appears in eggs, and is an important part of hemoglobin of the blood. The other minerals are needed in small quantities to prevent malformation of embryos. Most grains contain the so-called trace mineral elements, although continued raising of grain without proper fertilization or the use of purer fertilizers may eventually produce cereal grains that do not have sufficient mineral. Normally calcium and phosphorus are the only ones that have to be supplied.

MINERAL FEEDSTUFFS

Considerable interest, in recent years, has been shown in complex mineral supplements. It is probable that in most cases the use of simpler supplements, except where no variety of feedstuffs is used, would be just as beneficial to the bird. Some animal concentrates contain considerable mineral and additions should be made accordingly. Complex mixtures should, generally, be avoided unless a definite need is indicated.

Salt is added to increase the palatability and as an aid to digestion. It supplies both sodium and chlorine.

Bone Meal varies in composition depending on the method of manufacture. Raw bone meal, sometimes called poultry bone meal and steamed bone meal, are bones which have been cooked, dried and ground. Ground poultry bone is similar except that it is coarser. **Special steamed bone meal** is a by-product of gelatin or glue manufacture. Fertilizer bone is not suitable for poultry feeding. Bone meal is used to raise the phosphorus level of the ration when sufficient animal protein concentrates are not used.

Rock Phosphate resembles bone meal in composition but is not so satisfactory because it usually contains fluorine and other impurities.

Oyster Shell is a good source of calcium for egg shell formation. Owing to the varying requirements of calcium of birds in or out of production it is better to feed the shell in a separate hopper although some may be incorporated in the mash. In any case, oyster shell should be kept in hoppers to satisfy the maximum requirements of any individual bird.

Limestone as a mineral feed should contain 90% calcium carbonate.

Marl is satisfactory as a mineral feed if the calcium content is high and the impurities are low.

Grit such as gravel, mica, and granite, do not supply any mineral and may or may not be of value depending on the type of ration. They do no harm, apparently, so that cost is the deciding factor. Birds reared on free range do not require a great amount of commercial grit. Gravel apparently meets the birds' requirements. Soluble grits should be classified as a mineral supplement.

Mineral additions are necessary when vegetable protein concentrates are fed and the amount will depend upon the amount of concentrate used. Usually bone meal, limestone and salt are all that are necessary. Iron and copper are sometimes added as ferrous sulfate and copper sulfate.

THE VALUE OF A FEED

Chemical analysis of a feed is of very little value since it tells nothing of the protein value, the vitamin content, or the mineral elements. Feeding under actual conditions is the only accurate test of the final value of a feed. Knowledge of the proportions of certain ingredients and the analysis of the individual ingredients regarding vitamin potency and surplus or deficiency of minerals is more important.

When feeds are being compared all other conditions should be the same. Then any difference in production may be attributed to the feed.

Commercial feeds are usually more practical for the small flock owner or person who buys all of his feed. The farmer producing all or nearly all his own feed may purchase the suitable concentrates to supplement his home grown grains.

Nutritive Ratio is a term that is frequently heard in connection with discussions of feeding stuffs and rations. Nutritive ratio means the ratio between digestible protein and the digestible non-nitrogenous nutrients. A narrow nutritive ratio is obtained when a high amount of crude protein is present and a wide nutritive ratio when a low amount of protein is present.

The nutritive ratio is of little value in making up a ration for poultry, except in a general way, owing to the difficulties encountered in determining the digestibility of feedstuffs in the fowl. The nutritive ratio shows little concerning the quality of the protein or the vitamin content. Therefore, knowledge from various sources concerning the source and efficiency of the protein, along with the vitamin and mineral content of the ratio, is more valuable. These requirements vary with the age of the chicken. The total intake of crude protein from normal sources for the laying hen varies between 13.5 and 15 per cent, with considerable variation between individual birds. Therefore, the simplest way to obtain the best nutritive ratio for the laying hen is to supply a source of protein of a suitable nature that will compensate for the deficiency in the cereal grains.

Therefore, while it is well to know the proportion of protein to the carbohydrates and fats, it is more important to know something of (a) the quality and kind of protein, (b) the amount and kind of mineral needed, and (c) the amount and kind of vitamins necessary.

COST OF FEED

There is considerable fluctuation in the price of the various feeds. The cost of 100 pounds of feed is not the index of the value of the feed. The feed cost per dozen eggs or the feed cost per 100 chicks is the real index of the value of the ration. When changes are made owing to price, careful attention should be paid to the question of whether the new ration meets the requirements of the hen.

Use of much home-grown feed, properly supplemented, is economy if careful attention is paid to the quality of the supplements. In some cases commercial mashes and supplements will produce better results, particularly when mixing facilities and labor are factors or the supply of grain is not sufficient for both the mash and the scratch grain.

APPROXIMATE PERCENTAGE COMPOSITION OF FEEDSTUFFS USED FOR POULTRY

Feed Stuff	Crude Protein	Nitrogen-free Extract	Crude Fat	Crude Fiber
Alfalfa meal	13.0	35.8	2.0	30.1
Alfalfa leaf meal	20.0	41.2	3.4	12.7
Barley	10.0	68.4	2.2	6.5
Buttermilk (dried)	33.0	40.0	6.0	.....
Corn	10.0	71.0	3.8	2.3
Cottonseed meal	43.0	22.9	7.0	8.9
Fish meal, white vacuum-dried	60.0	3.0	8.0	.....
Meat scrap	50.0	5.0	6.0	3.0
Milk, dried skim	32.0	39.0	1.0	.....
Molasses	.....	50.9	.....	.....
Oat groats	16.4	66.0	5.9	1.9
Oatmeal, ground	16.3	64.1	5.9	2.8
Oats	12.0	59.1	4.7	11.5
Potatoes	2.1	16.3	.1	.6
Rye	11.1	73.7	1.7	2.1
Soybean oil meal	43.0	29.1	5.0	7.0
Wheat	12.0	71.1	1.8	2.4
Wheat bran	16.0	53.5	4.3	9.4
Wheat middlings	17.0	57.4	5.0	5.4
Whey, dried	13.0	25.9	2.7	.5

FEEDING PRACTICE

The feeding practice will depend upon the individual poultryman and the conditions under which the ration is fed. Complicated feeding practices may be desirable where routines are not upset and where the experience of the feeder is sufficient. Simpler practices, however, which would permit each hen to care for her own requirements seem to be more desirable and more practical.

Concentrate and Supplement—The words "concentrate" and "supplement" are used from time to time to indicate the addition of certain materials that are high in certain nutrients. "Concentrates" refer particularly to a feedstuff or mash that carries a high amount of protein. "Supplement" refers to the addition of vitamin and mineral carriers.

All-mash Laying Rations—All-mash laying rations are satisfactory when temperatures are fairly constant and when the mash is carefully prepared. The hen has no chance to eat different proportions of various ingredients so that more uniform eggs may result from its use. However, there is no opportunity for the hen to take care of her individual requirements. On the farm, where grains are produced, there is little if anything to be gained in grinding the grain for an all-mash ration.

Mash and Scratch Grain—This is grain fed at intervals, night, or night and morning. This method of feeding requires the use of an 18 to 20 per cent protein (crude) mash and is fed with about the same amount of grain each day. This method requires considerable skill and attention on the part of the feeder.

FORMULAS FOR MASHES WITHOUT MINERAL SUPPLEMENT

(Ground poultry bone, grit and oyster shell fed in hoppers.)

	All Mash	Mash and Grain	Mash and Grain	Mash and Grain	Grain in hoppers—30% concentrate	Grain in hoppers—26% concentrate	Grain and Breeding Mash
Ground corn	34	.....	25	28	.....	.....	.....
Ground barley	12	29	.....	.....	.....	.....	24
Wheat bran	18	15	17	15	19	9	15
Flour middlings	11	15	17	15	.....	8	15
Ground oats	14	14	14	13	.....	8	14
Alfalfa meal (dehydrated preferable)	3	8	8	8	20	20	10
Meat scrap	3	10	10	5	15	15	10
Fish meal (vacuum-dried)	2	3	3	5	15	12	3
Dried milk	2.5	5	5	5	12	12	6.5
Soybean oil meal	.....	.....	.....	5	15	12	.....
Dried whey powder	.....	.....	.....	.....	.....	.....	1.5
Salt	.5	1	1	1	2	2	1
Vit. D. Supplement U.S.P. 85 D	1.0	2.5	2.5	2.5	.....	.....	3
or 10 D	.3	.6	.6	.6	2	2	1
or 400 D	.2	.5	.5	.5	1.5	1.5	.75
Mineral supplement which may be added. Oyster shell should be fed in addition.							
Limestone	1.0	1.0	1.0	1.0	2	2.0	2.0
Steamed bone meal	.5	1.0	1.0	1.0	2	1.0	1.0

Mash and Scratch Grain Before the Flock at All Times—All feed is fed in hoppers. This simplifies the routine of feeding and eliminates possible loss owing to change of individuals doing the feeding. This method has proved satisfactory with concentrates and regular laying mashes. It complicates the problem of supplying sufficient vitamin supplements. This method is the most satisfactory for the average poultryman, provided the young stock has been raised in a similar manner. A skillful feeder using the usual system of grain feeding, may get more eggs but the majority of flocks do not receive such attention.

Wet Mashes—Wet mashes should be used only for special purposes. Once started, it is practically impossible to quit without a loss in production. Wet mash may be used to increase mash consumption during a molt or slump in the winter owing to loss of appetite and to maintain summer production. A small amount daily is all that should be used as the amount of labor is increased. It must be fed regularly when started since the birds depend on it. Enough water or liquid milk to make the mash wet and crumbly can be used with the regular mash. Vitamin supplements can be added easily when it is fed.

Lights—Although lights are not feeds, they are a part of the program owing to the stimulative effect. All-night lights with dim bulbs—10 watt bulbs over the feeders and waters, and morning lights—bright 40 watt—sufficiently early to allow a 13-to 14-hour day are more commonly used. Other combinations of light are possible but require more attention. Lighting should be regular once it is started.

Green Feed—Root crops or cabbage may be used but are not necessary. The problem of a uniform supply and storage makes it easier to supply most of the qualities added through the use of alfalfa hay or meal in the mash. The feeding value of root crops and cabbage is low. Sprouted oats show little, if any, advantage.

FEEDING FOR EGG QUALITY

Egg Size—The ration has very little influence on egg size, although it has been indicated that the quality of proteins does affect it slightly. Feeds supplemented with some milk seem to be the more satisfactory. Breeding, supply of feed and water and temperatures have a great effect.

A good supply of oyster shells or limestone with sufficient vitamin D results in thicker shells and in that way the weight is affected.

Shell Quality—Sufficient limestone or oyster shells and sunshine or vitamin D supplement must be available to produce strong shells. A few hens will lay eggs without shells. This is an individual abnormality or hereditary trait not influenced by the ration.

Quality of Albumen—Heavy feeding of succulent or green feeds may result in thin egg whites. Heavy feeding of certain protein concentrates beyond a normal amount may produce colors in the egg white. Infrequent gathering and improper cooling of the egg is probably the greatest source of trouble.

Yolk Color—The color of the yolk is due, principally, to a pigment, xanthophyll, found in yellow corn, green grass, and alfalfa meal. Birds on range lay darker yolks than those confined and on the same ration.

Taste—Excessive quantities of fish oils or fish meals may produce a decidedly fishy taste in the egg.

Vitamin Content—The vitamin content of the egg can be greatly influenced by the presence or absence of the vitamins in the feed.

FEEDING FOR HATCHABILITY

A better ration is required for the production of hatching eggs than for egg production alone. Commercial egg production can be obtained on cheaper rations but it is doubtful if they are justified. The rations that produce hatchable eggs result in better livability and resistance to disease, and increase the egg's food value.

Particular attention must be paid to the amount of vitamins present and the quality of the protein. Usually a mash, containing milk in sufficient amounts to provide a minimum intake of 2.5 per cent of the total feed consumed on a dry basis, will satisfy the vitamin G requirement. Fish meals and liver meal may be helpful. Green feeds or a substitute is necessary to supply certain vitamins. Dehydrated alfalfa leaf meal is to be preferred. The breeding flock requires about 50 per cent more vitamin D than the commercial egg flock.

Michigan State College of Agriculture and Applied Science and U. S. Dept. of Agriculture cooperating, R. J. Baldwin, Director Extension Division. Printed and distributed under act of Congress, May 8, 1914.

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