

POULTRY FEEDS AND FEEDING

BY GEORGE ROBERTSON

ASSISTANT DOMINION POULTRY HUSBANDMAN



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TABLE OF CONTENTS

	PAGE
Introduction.....	3
A Balanced Ration.....	3
Protein.....	3
Carbohydrates.....	3
Fats.....	3
Ash.....	5
Vitamines.....	5
Vitamine content of feeds.....	5
Digestible nutrients.....	8
Nutritive ratio.....	8
Grains and By-Products.....	9
Wheat.....	9
By-products of wheat.....	9
Buckwheat screenings.....	9
Standard re-cleaned screenings.....	9
Bran.....	9
Shorts, middlings.....	9
Low-grade flour.....	9
Wheat germ.....	10
Stale bread.....	10
Shredded wheat waste.....	10
Corn.....	10
Corn meal.....	10
By-products of corn.....	10
Gluten meal.....	10
Gluten feed.....	10
Bran, middlings and hominy meal.....	10
Oats.....	10
Oatmeal.....	11
By-products of oats.....	11
Buckwheat.....	11
By-products of buckwheat.....	11
Barley.....	11
Brewer's grains.....	11
Malt sprouts.....	11
Rye.....	11
Rice.....	11
Millet.....	12
Sunflower seeds.....	12
Peas.....	12
Linseed meal.....	12
Oil-cake meal.....	12
Cotton-seed meal.....	12
Other seeds.....	12
Green Feeds.....	12
Garden truck.....	13
Rape.....	13
Green crops.....	13
Clovers and alfalfa.....	13
Alfalfa and clover meals.....	13
Jerusalem artichokes.....	13
Beets.....	13
Turnips.....	13
Apples.....	13
Sprouted grains.....	13
How to sprout grain.....	13

TABLE OF CONTENTS—*Concluded*

	PAGE
Animal Feeds.....	15
Fresh meat.....	15
Green cut bone.....	15
Other meat feeds.....	15
Fish scrap.....	15
Milk.....	16
Cottage cheese.....	16
Eggs.....	16
Table of Composition and Digestible Nutrients of Feeds.....	16
Mineral Feeds.....	17
Bones.....	18
Shells.....	18
Grit.....	18
Charcoal.....	18
Table of mineral salts in feeding stuffs.....	18
Feeding Methods.....	19
The hopper system.....	19
The moist mash system.....	21
Rations.....	22
Fowl.....	22
Chicks.....	22
Laying pullets.....	24
Stock birds.....	24
Crate fattening.....	25
Turkeys.....	25
Poults.....	25
On range.....	25
Fattening.....	25
Stock birds.....	26
Guinea and Peafowl.....	27
Ducks.....	27
Ducklings.....	27
Fattening.....	28
Stock ducks.....	28
Geese.....	29
Goslings.....	29
Fattening.....	30
Stock geese.....	30

POULTRY FEEDS AND FEEDING

BY GEORGE ROBERTSON

It has been the endeavour to make the subject of feeds and feeding as simple as possible. While it has seemed advisable to try to familiarize the uninformed reader with the more common scientific terms, this has been done only to such an extent as will permit the reader to study and mix feeds intelligently. Wherever terms that might be unusual to ordinary poultry keepers are used, care has been taken to explain them as simply as possible, so that any person reading the bulletin through should have no trouble in following it.

While sample rations are given for each kind of stock, it must not be supposed that these are given as the only rations or even as the best rations. They are simply indications of about what the various rations might consist. The make-up of a ration should depend altogether on what feeds are available, always bearing in mind the various requirements.

A BALANCED RATION

The feeding of poultry is more or less like the feeding of any other live stock, and the ration used must be varied according to the purpose for which it is intended. For successful feeding it is necessary to use grains, both whole and ground, green food, animal food, mineral food and water liberally supplied. Charcoal may also be used to advantage.

These feeds must not only be supplied, but they must be supplied in such quantities that they will form a ration suited to the purpose for which it is intended. Such a ration is called a balanced ration.

A balanced ration is one that contains protein, carbohydrates, and fat—the elements of nutrition—in the proportion required for the maintenance and activities of the animal to which it is fed. This however is not all. In the light of more recent knowledge, it is known (1) that it is essential that the ration contain protein, not only ample in amount, but of the right kind, (2) that there be an adequate supply of mineral matter and (3) that the ration contain sufficient vitamins of the right kinds.

Protein.—Protein is the nitrogenous part of the food, and is largely used for growth, the repairing of waste tissue, and for production.

Proteins are not all alike; some contain all the known amino acids—eighteen of which have already been identified—while others are deficient in one or more of them. Research has indicated that “if the protein part of the diet is deficient in the amino acids lysine, and typtophane, life is impossible.”* The production of eggs and similar products depends largely on the protein in the feed.

Carbohydrates.—Carbohydrates are largely starches and sugars, and are used for the supplying of bodily heat and energy.

Fats.—Fats are frequently classed as carbohydrates. They serve the same purposes, but are more highly concentrated.

An overplus of protein in a ration may be used to replace a shortage of carbohydrates and fat, but as protein is the most expensive element to supply it is not economical to use it for that purpose. Carbohydrates and fat, on the

* Osborne and Mendel, J. A., M.A., 1915.

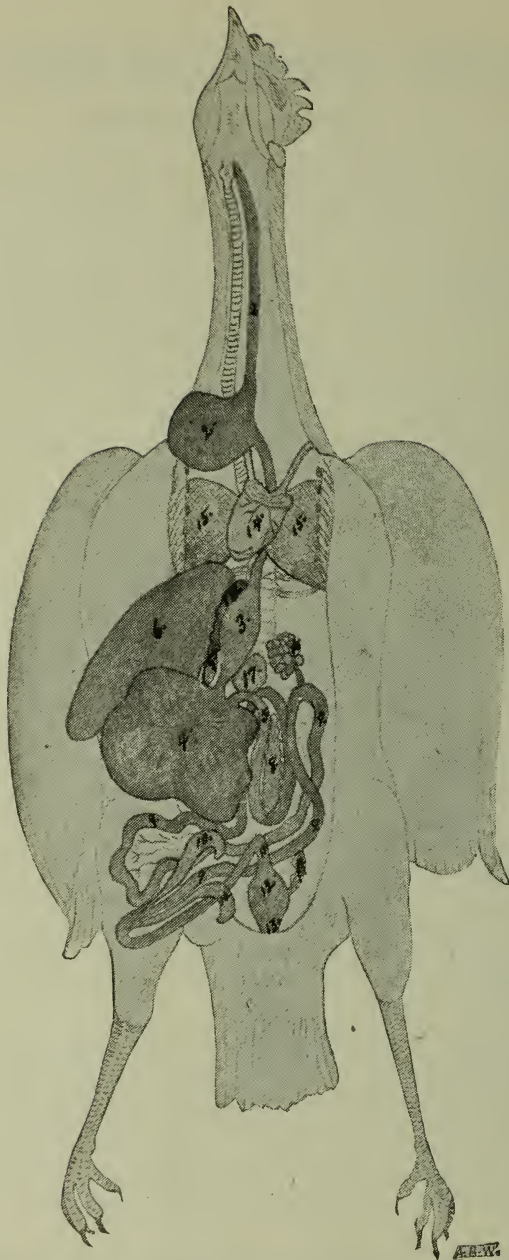


FIG. 1.—DESCRIPTION OF PLATE SHOWING DIGESTIVE ORGANS OF FOWL

The food after entering the mouth passes into the Gullet (No. 1) thence into a sack-like enlargement of the former, called the Crop (No. 2), from where it passes into the true Stomach (No. 3), where it is mixed with the digestive juices, after which it passes into the Gizzard (No. 4), where it is ground fine; then into the Duodenum (No. 5) (first portion of the small bowel), where a secretion from the Liver (No. 6) called Bile which is stored in the Gall Bladder (No. 7) and also the juices from the Pancreas (No. 8) are mixed with it; then passes through the long Intestine (No. 9) where absorption takes place and into the Caeca (No. 10), after which the residue is passed on into the Rectum (No. 11) and through a continuation of the rectum called the Cloaca (No. 12) (junction of the intestine and the oviduct) to be voided at the Vent (No. 13).

Other organs shown are: (No. 14) Heart, (No. 15) Lungs, (No. 16) Ovary, (No. 17) Spleen, (No. 18) Margin where left lobe of liver has been removed, (No. 19) Oviduct.

Original drawing by Dr. A. B. Wickware.

other hand, cannot take the place of protein, so that a ration deficient in protein, no matter how rich in carbohydrates and fat, cannot give good results.

Ash.—Besides the three fore-mentioned elements, ash, which is the term used to designate the mineral compounds, is also of importance, as it enters largely into the formation of bones and egg shells. At present there is little definite data as to the amount of mineral elements required in a ration to permit of normal growth or heavy egg production. It is therefore advisable to supply them freely so that there may always be a greater supply than is actually required.* Experiments with mammals have shown that rations deficient in mineral matter will in some cases cause abortion and in other cases cause the offspring to be born in a puny, undeveloped state. Is there any reason to think that conditions that would have such effects in the case of mammals would not result in chicks dead in the shell or in puny, sickly chicks? What has been pointed out in the matter of proteins and mineral compounds indicates the necessity for variety in the ration, working on the principle—that what is lacking in one feed must be supplied by another.

Vitamines.—Vitamines are substances essential to life that are present in certain feeds in such minute quantities and character as to be invisible.

While vitamins are as old as life, their discovery is of more or less recent occurrence and as yet comparatively little is known of them. So far as is known, they are manufactured only by plants and no test for determining their chemical composition has been discovered. Fat-Soluble A, Water-Soluble B and C have been generally accepted.

1. Fat-Soluble A.—The anti-rachitic vitamin is of great importance to poultry keepers as the absence of this vitamin or its presence in insufficient quantities will cause leg weakness in chicks.

Recent investigations have indicated the possible necessity of considering this as two vitamins rather than one,—the one relating to growth and ophthalmia, the other to rickets. However, as they frequently occur together they may in ordinary feeding practice be considered as one.

Cod-liver oil is a rich source of this vitamin and experiments have shown that it will prevent leg weakness in chicks or correct it after it does appear.**

2. Water-Soluble B.—The anti-neuritic vitamin is of great importance to poultry keepers as a deficiency will cause polyneuritis in fowl. However, as it is present in most ordinary feeds such as cereals and the leafy parts of plants, any ordinary ration should supply it in sufficient quantity. Yeast is an exceptionally rich source of this vitamin.

3. Vitamin C.—The anti-scorbutic vitamin of great importance to human dieting, especially in the feeding of bottle-fed babies—where orange juice, a rich source of supply of this vitamin, is frequently added to the menu—is as far as is known of no importance in the feeding of poultry.

4. Vitamin D.—As mentioned in referring to vitamin A there is a tendency to consider this as two rather than one vitamin, the letter A being given to the anti-ophthalmic vitamin and the letter D to the anti-rachitic.

Recent investigation has also pointed to a vitamin connected with reproduction, but so far as is known vitamins A and B are the only two that need be considered from a poultry-feeding standpoint.

VITAMINE CONTENT OF FEEDS

The vitamin content of comparatively few feeds has been carefully determined, so that the following table is incomplete and the data should be taken as tentative rather than definite. Because of the general interest in

* Wisconsin Experimental Station Bulletins 49 and 350.

** See Experimental Farms Report for 1924.

vitamines. data are also given for foods that are not regarded as specially applicable to poultry feeding.

The table is compiled from data taken from Report No. 38 of the British Medical Research Committee (indicated by "1") and from Henry and Morrison's Feeds and Feeding (indicated by "2.")

The relative amounts of the different vitamins in each feed are indicated by the following symbols:—

? Indicates a lack of knowledge of the vitamine content.

— or O Indicates a total, or almost total, absence of the vitamine.

X Indicates the presence of a small amount of vitamine.

XX Indicates the presence of the vitamine in quantities sufficient to make a good source of supply.

XXX Indicates the presence of the vitamine in quantities sufficient to make an extra good source of supply.

XXXX Indicates the presence of the vitamine in quantities sufficient to make an exceptionally good source of supply.

As in report No. 38 of the British Medical Research Committee the XXXX sign is not used, where XXX occurs it may be taken to indicate the same as XXXX in Henry and Morrison's Feeds and Feeding. Where the authorities show a variance, both are given.

TABLE 1.—VITAMINE CONTENT OF FEEDS

Foods	Authority	Fat-Sol. Vitamine A	Water-Sol. Vitamine B	Anti-Scorbutic Vitamine C
<i>Cereal</i>				
Wheat.....	1	X	X	0
Wheat.....	2	—	X X	—
Wheat bran.....	1—2	—	X X	—
Wheat germ.....	1	X X	X X X	—
Wheat middlings.....	2	—	X X X	—
Wheat, white flour.....	1	0	0	0
Patent flour.....	2	—	X	—
Corn.....	1	X	X	0
Corn, white.....	2	—	X X	—
Corn, yellow.....	2	X X	X X	—
Corn, flour.....	1	0	0	0
Oats.....	2	—	X X	—
Barley.....	2	—	X X	—
Rice, whole grain.....	1	X	X	0
Rice, whole grain.....	2	— to X	X X	—
Rice, polished.....	1—2	—	—	—
Millet.....	2	— to X X	X X	?
Millet and linseed.....	1	X X	X X	0
Peas.....	1	0	X X	0
Peas.....	2	— to X	X X	—
Peas, (kiln-dried) flour.....	1	0	0	0
Beans.....	2	—	X X	—
Beans, Soy.....	1—2	X	X X	0
<i>Vegetable</i>				
Beets, (red or sugar).....	2	—	— to X	— to X
Beets (raw juice).....	1	—	—	Less than X
Mangel.....	2	—	— to X	— to X
Cabbage, fresh.....	1	X X	X	X X X
Cabbage, white portion.....	2	X X	X X	X X X
Cabbage, green leaves.....	2	X X X	X X	?
Cabbage, cooked.....	1	—	X	X
Cabbage, dried.....	1	X	X	Very slight
Cabbage, canned.....	1	—	—	Very slight
Carrots, fresh, raw.....	1	X	X	X
Carrots, yellow.....	2	X X	X X	X X
Carrots, white.....	2	— X	X X	?
Carrots, dried.....	1	Very slight	—	—
Potatoes, raw.....	1	X	X	—
Potatoes, cooked.....	1	—	—	X

TABLE 1.—VITAMINE CONTENT OF FEEDS—Concluded

Foods	Authority	Fat-Sol. Vitamine A	Water-Sol. Vitamine B	Anti-Scorbutic Vitamine C
<i>Vegetable—Con.</i>				
Potatoes, Irish.....	2	— to X	X X	X X
Potatoes, sweet yellow.....	2	X X	X X	?
Squash.....	2	X X	?	?
Onions.....	1			X (at least)
Beans, green, raw.....	1			X X
Lettuce.....	1	X X	X	
Spinach, dried.....	1	X X	X	
Turnip, swede (raw juice).....	1			X X X
Rutabagas.....	2	?	X X	X X X
Tomatoes, raw.....	2	X X X	X X X	X X X
Tomatoes, canned.....	1			X X
Apples.....	1	0	0	X
Apples.....	2	?	X	X
Orange juice, fresh.....	1			X X X
Lemon juice, fresh.....	1			X X X
Oats, green, sprouted.....	2	X	X X	X
Pulses or cereals (germinated).....	1	X	X X	X X
Corn silage.....	2	X X	?	—
Clover, green.....	2	X X X	X X	X X X X
Clover hay.....	2	X X X	X X	—
Alfalfa, green.....	2	X X X	X X	X X X X
Alfalfa hay, well cured.....	2	X X X	X X	—
Alfalfa hay, bleached.....	2	—	?	—
Grasses, green.....	2	X X X	X X	X X X X
Timothy hay (well cured).....	2	X X	X	—
<i>Animal</i>				
Lean meat (beef, mutton).....	1	X	X	X
Fat (beef, mutton).....	1	X X		
Liver.....	1	X X	X X	X
Kidney or heart.....	1	X X		
Brain or sweet breads.....	1	X	X X	
Meat extract.....	1	?	0	0
Meat, canned.....	1	0	Very slight	0
Lard.....	1—2	— Variable	—	—
Fish, white.....	1	0	Very slight if any	
Fish, fat (salmon, herring, etc.).....	1	X X	“ “	
Fish roe.....	1	X	X X	
Cod-liver oil.....	1—2	X X X X	—	—
Fish-oil.....	1	X X		
Milk, whole raw.....	1	X X	X	X
Milk, whole raw.....	2	X X X	X X	X variable
Milk, boiled, whole.....	1	Undetermined	X	less than X
Milk, dried, whole.....	1	Less than X X	X	less than X
Milk, condensed, sweetened.....	1	X	X	less than X
Milk, skimmed, raw.....	1	0	X	X
Milk, skimmed, raw.....	2	X	X X	X variable
Milk, buttermilk.....	2	X	X X	X variable
Cream.....	1	X X	0	
Cream.....	2	X X X	X	X variable
Butter.....	1—2	X X X	0	
Cheese.....	2	X X	?	?
Cheese (whole milk).....	1	X		
Cheese (skimmed milk).....	1	0		
Eggs, fresh or dried.....	1	X X	X X X	? 0
Eggs, fresh or dried.....	2	X X	X	?
<i>Miscellaneous</i>				
Yeast.....	1—2		X X X X	
Malt extract.....	1	X in some specimens		
Beer.....	1	0		0
Peanut oil.....	1	X		
Olive oil.....	1	0		
Cottonseed oil.....	1	0		
Cocanut oil.....	1	0		
Coca butter.....	1	0		
Linseed oil.....	1	0		
Nut butter.....	1	X		

DIGESTIBLE NUTRIENTS

While the composition of the various foodstuffs, as determined by chemical analysis, is to a certain extent indicative of their value, the only reliable test is by actual feeding experiments. These experiments consist in the weighing and analysing of the feed of which it is desired to find the value, feeding it, and collecting, weighing, and analysing all the resulting excrement. The difference between the weight and analysis of the feed and the excrement is the amount assimilated or digested, or, in other words, the digestible nutrients. In compounding a ration, the use of figures representing digestible nutrients would be the best method to follow, but as comparatively few reliable feeding experiments have been carried out with poultry, it is necessary in many cases to depend on the feeding results with some of the larger animals.

In the table of feeds, table 2, the figures used representing the digestible nutrients were taken from the reports of poultry-feeding experiments where possible. Where these were not available, the figures given were taken from the results of feeding experiments with some of the larger animals. The composition of the feeds is also given in the table.

THE NUTRITIVE RATIO

As the term nutritive ratio will be used frequently in this bulletin, it will be necessary to have a clear understanding of its meaning.

The nutritive ratio is the ratio which exists between the protein in a given feed and the carbohydrates and fats. For example, wheat contains 11.9 protein, 71.9 carbohydrates, 2.1 fat. The fat being much more concentrated, to bring it to the same value as the carbohydrates it must be multiplied by 2.25. Therefore, to find the nutritive value of wheat, multiply the fat, 2.1, by 2.25, add the carbohydrates 71.9, and divide by the protein 11.9, which gives 6.4 or, in other words, for every one part of protein there are 6.4 parts of carbohydrates, so that 1 : 6.4 is the nutritive ratio of wheat.

In referring to rations the terms "narrow" and "wide," we refer to the amount of protein in comparison to the combined amount of carbohydrates and fat. These are relative terms, and are in no way fixed. Where the difference between the percentage of protein and carbohydrates is not large, the ration is said to be narrow, and where the difference is great the ration is said to be wide.

A ration that is more or less generally accepted as suitable may be conveniently used with which to compare other rations; for instance, a suitable chick ration would have a nutritive ratio of about 1 : 3.5 to 1 : 4.5. The feathering period calls for a ration rather narrower than the ordinary growing period. The same applies to mature fowl; a maintenance ration would have a nutritive ratio of from 1 : 6 to 1 : 6.5, and a fattening ration may be even a little wider, but when a flock is laying heavily, the ration should be narrower, about 1 : 4 to 1 : 5, and during moulting even narrower still, about 1 : 3.5.

It will be readily seen from the foregoing that, in compounding rations, it is advisable to consider the object for which the ration is intended. It is not meant by this carefully to weigh out a given quantity of each variety of feed each day, but it is advisable so to feed that the fowl will be able to get enough of each food element to satisfy the demands that are being made on its system without having to consume far more of other food elements than it can properly make use of. For instance, it is impossible to feed a fowl an exclusive corn diet and expect it to lay well or to come through the moult in good condition. To get the amount of protein that it requires, it will be necessary for it to consume far more carbohydrates than it needs; the result will be that the overplus of carbohydrates will be stored as fat, and the fowl will get into such a condition that it will be useless for anything except market purposes.

On the other hand, it is not advisable to use a larger amount of protein than is required, as it is the most expensive element and, consequently, an overplus of protein would unnecessarily increase the cost of the ration.

GRAIN FOODS AND THEIR BY-PRODUCTS

The grains most popular are wheat, corn, and oats. Barley and buckwheat are also largely used, and some other grains to a less extent.

WHEAT

Wheat is undoubtedly more largely used in Canada for feeding poultry than any other single grain. There are several reasons why this should be so. There is such an enormous quantity produced that there is always an available supply of the lower grades. The kernels are of good size for feeding, are palatable, are free from objectionable hull, and contain the principal nutrients in about the proper proportions. The lower grades usually make excellent feed; in fact, shrunken wheat is considerably richer in protein than the higher-grade wheats, but, when buying it, precaution must be taken to see that it is perfectly sweet, as musty or fermented feeds are always dangerous to use.

By-Products of wheat.—The by-products of wheat are extensively used, and provide some of the best foods for the feeding of all kinds of poultry.

BUCKWHEAT SCREENINGS.—Buckwheat screenings, so called, are a by-product from the elevators. They consist of approximately 50 per cent small or broken wheat, 40 per cent wild buckwheat, 2.5 per cent light oats, 1 per cent flax seed, and 6.5 per cent weed seeds, chaff, and other refuse. It is a valuable feed, and particularly for fattening purposes may be used to advantage. However, on account of the danger of spreading noxious weeds it is advisable to either grind all screenings, or to cook them thoroughly before feeding. (See report of Poultry Division for 1914.)

STANDARD RE-CLEANED SCREENINGS.—When during the war it was decided that screenings would of necessity have to be largely substituted for the milling grades of wheat in the feeding of poultry, a definite standard was set on which screenings would be sold. This grade which was named Standard Re-cleaned screenings, consists of approximately 52.7 per cent small and broken wheat, 23.2 per cent wild buckwheat, 2.3 per cent flax seed, 9.5 per cent oats, 12.3 per cent black seeds, straw and other refuse.

BRAN.—Bran is composed of the coarser outer coating of wheat, and is valuable in the making of mashes, not only on account of its nutritive qualities, but for its effect in supplying bulk with other feeds which, used alone, would make a mash that would be too sticky.

SHORTS, MIDLINGS.—For some years the terms shorts and middlings were used indiscriminately and meant anything from re-ground bran with a little mill sweepings thrown in, to middlings proper, which is a high-class feed more closely resembling low-grade flour. Fortunately, under the Amended "Feeding Stuffs Act" a standard is set for each, so that a purchaser knows when he orders either one or the other just what he may expect.

Shorts consist of fine particles of bran, germ and a small proportion of the floury parts of the grain. It is a valuable feed but as it does not contain as much flour as middlings is not so suitable for mixing with bran.

Middlings have less crude fibre, are richer in nutrients than shorts, and give more "body" to a mash. Either middlings or shorts is the foundation of most Canadian mashes. In some localities, it is impossible to get a good grade of middlings, in which case dependence had better be placed on "Red Dog" or low-grade flour.

LOW-GRADE FLOUR.—Low-grade flour is not only a nutritious feed, but it is especially valuable in giving the proper consistency to a mash.

WHEAT-GERM.—Wheat-germ is the germ part of the wheat which is removed in milling. It is flakey in appearance and on account of the low fibre content and to the fact that it is rich in vitamins it is a very valuable addition to the ration.

STALE BREAD.—Stale bread is a very palatable feed, and is of special value in the feeding of young stock.

SHREDDED-WHEAT WASTE.—Shredded-wheat waste is a by-product from the manufacture of shredded wheat biscuits. It is baked shredded whole wheat, and is very palatable. Fed soaked in milk it is greedily eaten and, when procurable, it is an acceptable addition to the poultry menu.

CORN

Corn has never been fed in Canada as freely as in the United States. This is no doubt due to the fact that corn is not produced here to the same extent. The idea is prevalent among poultry keepers that flint corn is the best, but it is doubtful if there is much ground for this idea, as the analysis of the two are very similar.

However, research has shown that yellow corn contains Fat-Soluble Vitamine A, which is entirely missing in white corn.

Whole corn is so large that care must be taken in its use, or the fowl will obtain a full meal with very little exercise, and rapidly become too fat. On that account, it is much better to have the corn cracked and scattered in the litter so that the flock will have to work for it. Corn heats very readily, and unless it is kiln-dried it is almost impossible to keep it from spoiling in warm weather. Care should be taken to see that it is perfectly "sweet", as there is always danger in feeding if mouldy. Corn, being rich in carbohydrates, may be much more freely used in winter than during the warmer weather.

Corn meal.—Most of the mashers used contain more or less corn meal, and what was said with reference to the precaution necessary to avoid the use of tainted corn applies even more to corn meal or corn chop.

By-products of corn.—The by-products of corn are not used to any great extent in Canada, but where they can be obtained at sufficiently low prices they may be used advantageously.

GLUTEN MEAL.—Gluten meal is very rich in both protein and fat, and is a valuable addition to the mash when used in conjunction with other feeds. In buying feeds of this kind it is always best to insist on a guaranteed analysis being supplied, and in gluten meal especially is this necessary as there is frequently great differences in feeding value.

GLUTEN FEED.—Gluten feed should not be confused with gluten meal. It is a combination of gluten meal and other by-products such as bran, and is not nearly so rich in nutrients.

BRAN, MIDDLINGS AND HOMINY MEAL.—These are not available in this country to any extent. The bran is considerably lower in food value than corn meal, but the middlings and hominy are somewhat higher.

OATS

Many poultry keepers do not give oats the place in the ration they should have. This is probably due to the fact that much of the oats that are placed on the market are not properly filled, and when offered to fowl, are not eagerly eaten.* Oats have a fibrous hull, and it is probably largely on that account that fowl take more readily to wheat or corn, but where oats are of good quality, they are an excellent feed, and as soon as the flock becomes accustomed to them, they will eat them readily.

* The Liberty oat, originated by Dr. C. E. Saunders, when Dominion cerealist, threshes out free from hull and will doubtless prove most valuable in poultry feeding by removing this difficulty.

Oatmeal.—Oatmeal was formerly used to a considerable extent in the feeding of chicks, and at the present time pinhead oatmeal is used in nearly all chick-grain mixtures, but rolled oats are now used much more freely. It is a very valuable feed and where it can be obtained at a reasonable price, should be used. Many high-class breeders use it freely for the feeding of chickens even when they have to purchase the superior product intended for human food, and claim that even at that cost, the results justify its use.

By-products of oats.—By-products from the oatmeal mill are not now readily obtainable, as they are generally put into mixtures and sold as such. Oatmeal siftings or mealine is the best of these. It is an excellent feed and where obtainable may well be used.

BUCKWHEAT

In some sections buckwheat is utilized to a considerable extent. Like oats, fowl have to become more or less accustomed to it, but once used to it they eat it readily. Ground buckwheat is especially valuable in crate feeding. It produces white flesh of fine flavour.

By-products of buckwheat.—It is so seldom that the by-products of buckwheat can be had that they are hardly worth mentioning. The middlings is a high-class feed and may be used to advantage for feeding in mashers to any class of fowl.

BARLEY

There is very little difference in the analysis of barley and wheat, the barley being a little higher in protein. The hull makes it less palatable, but fowl soon become accustomed to it, and consume it readily. It might well be used to a far greater extent than it is, as it apparently gives almost as good results as wheat, and is usually much cheaper. Barley meal is used to a considerable extent, especially in crate feeding. It gives satisfactory results both in quantity and quality of flesh produced.

Brewers' grains.—Brewers' grains, when fed fresh from the breweries, make an excellent feed, but care should be taken to see that they are fresh, as they are otherwise liable to flavour the eggs. Dried, they may be used to advantage as they keep well and are rich in both protein and fat.

Malt sprouts.—In the process of malting to change the starch of the grain into sugar it is necessary to produce a natural ferment called diastase. To develop this ferment it is necessary to sprout the grain, and as it is the change that is desired and not the actual sprout, the sprouting is checked as soon as the change takes place. The whole is then kiln-dried and the sprouts are separated from the grain by means of sieves, and sold as stock feed. As they contain a high percentage of protein they make a valuable addition to a ration, but they are best fed in combination with more palatable feed, as they are not greatly relished.

RYE

Although, in analysis, rye shows very little below wheat in feeding value, it is in very little favour as a poultry feed. Fowl do not like it and, unless they are forced to eat it by having other grains curtailed, they will consume it in only very limited quantities. Its by-products are practically not available in this country.

RICE

Rice is rarely used except in the feeding of young chicks. There is generally broken rice in all chick-grain mixtures, and in special instances it is sometimes

boiled and fed like a mash, in which condition it is eaten with relish. Boiled rice is of especial value as a regulative in case of bowel trouble*

MILLET

Millet is very similar to oats in composition, but, like rice, it is used mainly in chick feeds. It appears to be particularly attractive to the chicks, as it is one of the first grains they will pick out when they are fed mixed grains.

SUNFLOWER SEEDS

Sunflower seeds are not fed extensively, but many town poultry keepers grow a patch of sunflowers for their fowls, bending the head down as soon as the seeds fill, and allowing the hens to help themselves. They are of especial value to "fanciers," who use them at moulting time and also for getting coloured birds ready for the show, as they give the coveted gloss to the plumage.

PEAS

Peas are not used to any great extent, probably because they are not readily procurable at prices that would make them profitable to feed. They are a valuable and excellent feed and used in combination with other grains, are readily eaten and give very good results. Most chick feeds contain broken peas.

LINSEED MEAL

Flaxseed in the whole state is practically never fed, but ground flax, or linseed meal as it is called, is used to a considerable extent in mashes. It is very concentrated, and should be fed sparingly; otherwise, digestive troubles are likely to result.

Oil meal.—Oil cake or oil meal is simply linseed meal from which the oil has been extracted by pressure.

COTTON-SEED MEAL

Cotton-seed meal is another feed which requires caution in feeding, as it is not only a very rich feed, but it seems specially liable to cause digestive disorders. It contains a large percentage of protein but, for the reasons stated, it has not been used to a great extent in this country, and other feeds are preferred as a source of protein.

OTHER SEEDS

Other seeds such as sorghum, kaffir corn, rape and broom corn are all good feeds, but scarcely require mentioning, as they are used only in small quantities in chick-feed or scratch-grain mixtures.

GREEN FEEDS

Green feed in some form is an essential to maintain the flock in a healthy vigorous condition. It not only supplies succulence but it is the original source of vitamins, and it is on this source that dependence should largely be placed for the supply of these substances, as under ordinary conditions they may be supplied more economically in green feed than in any other form. Reference to the table "Vitamine Contents of Feed," table I, will show the value of various green feeds as a source of supply.

* See Experimental Farms Report for 1915, vol. II, page 1148.

Garden truck.—Cabbage, lettuce, onion tops, or practically any waste garden truck may be utilized in the poultry yard. Unmarketable carrots, parsnips, onions, small potatoes, or similar roots may be stored and fed in the winter.

Rape.—Rape is one of the best crops to grow for green feed for summer use where fowls are more or less confined. It is easily grown, gives a large yield, and fowls eat it with avidity. It is an excellent crop to freshen the runs after the breeding season.

Green crops.—Corn, oats, rye, barley, and wheat all make good green fodder if cut at the right time and chopped into short lengths so that the fowl can readily eat them. They are especially useful in the feeding of waterfowl.

Clovers and alfalfa.—Clovers and alfalfa may be cut green and used as fodder, or they make excellent pasture. Properly cured, they are of great value for winter feeding. The leaves usually found in mows where the hay has been stored are of especial value, and on many farms they are reserved for the use of the poultry.

Alfalfa and clover meal.—Much of the value of hay is lost if it is not cut before it gets too ripe. As it is much easier to grind it matured, the result is that most of the meals are made from hay that has lost a great deal of its feeding value by being left until it is too old. Meal made from well-cured early-cut hay is excellent feed, but unless sure of the quality it is safer to buy the hay unground, as the quality can be more readily determined.

Jerusalem artichokes.—Jerusalem artichokes are of much greater value as a crop for poultry feeding than is generally realized. The tops may be used as green fodder in summer or the tubers as roots for winter feeding. Both are readily eaten. The plant resembles the sunflower, but it is finer in growth, having smaller leaves, stalks, and flowers. Growing as it does to a good height, it also makes an excellent shade during the hot weather.

Beets.—For winter feeding, mangels and beets are a handy form in which succulence can be provided. They are easily grown, yield a large amount of feed per acre, keep well, are handy to feed, and fowl are exceedingly fond of them. Care should be taken in planting them to see that the most suitable varieties are used. Some of the varieties of beets are not so readily eaten as others. Avoid planting those that are very hard in the flesh, as fowl prefer those that are tender.

Turnips.—Turnips are not so readily eaten in the raw state as are mangels, but when fowls become accustomed to them they eat them readily.

Apples.—Apples, especially some of the sweeter varieties, are eaten with relish by poultry, and where chickens are given the run of an apple orchard they will eat large quantities of windfalls.

Sprouted grains.—The use of sprouted grains, especially oats, is common, particularly among breeders. The process of sprouting is simple; it necessitates a good deal more work than the feeding of roots, but it is well worth while, especially for feeding the breeding stock, as they are exceedingly fond of it and it keeps them in excellent condition.

TO SPROUT GRAINS

Under this heading there are two distinct products to be considered. One, germinated grain, fed when the sprouts are about half an inch in length; the other, fed when the sprouts are two to three inches in length.

The latter requires much more space and labour to produce, and a room that is fairly warm. This method is only recommended for the feeding of the baby chicks before they can get on to grass ranges.

Soak the oats for twelve hours in warm water, then drain and allow them to stand for another twelve hours, after which they should be spread out about an inch deep where the drainage will be good. Water freely twice a day until ready for use, which in a suitable place will be in about six or seven days. It may be grown on the floor or in racks similar to that shown in Fig. 2. When the grain

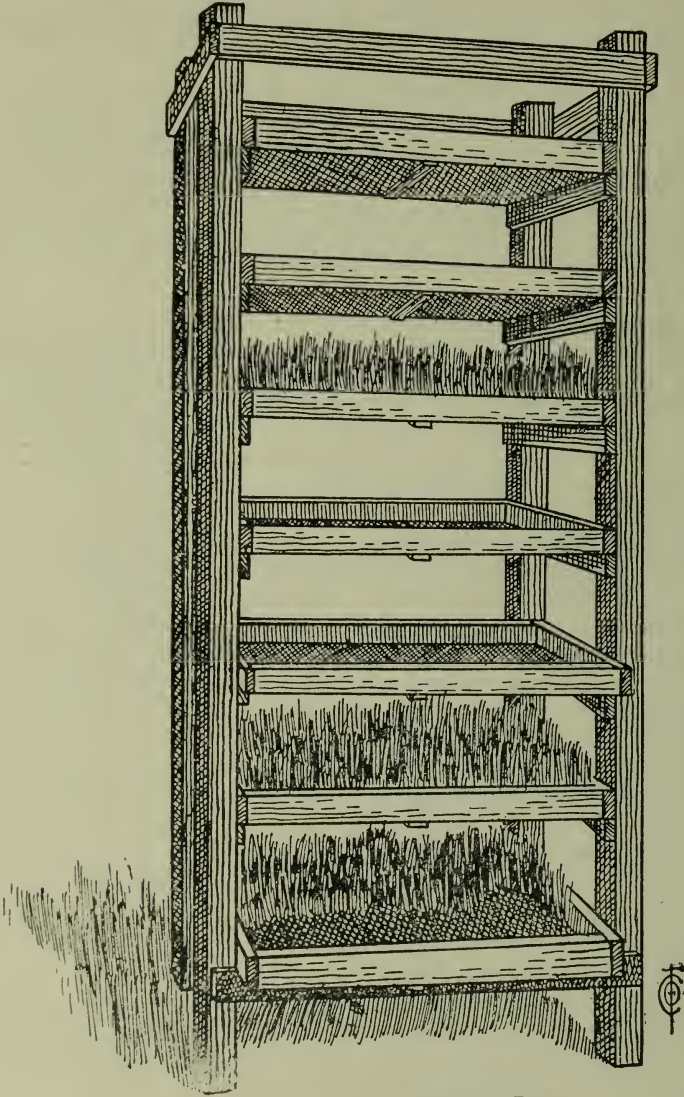


FIG. 2.—GRAIN SPROUTING RACK

Of simple and cheap construction. The bottoms of the trays are fine wire cloth, permitting free drainage. This rack provides sufficient sprouting space for a small poultry plant. The sloping bench method of sprouting (page 15) is the best for a larger flock.

is ready to feed it is taken out of the trays in a solid mat and torn or cut into pieces to suit the size of the flock. The little chicks will tear at this just as they would at a clover sod, eating the roots as eagerly as the tops.

The method where the grain is simply germinated is followed where large quantities are required for the feeding of mature stock. The operation is simple and large quantities may be sprouted with comparatively little labour and in a building too cool to successfully grow the long-sprouted grain.

In this method the grain may be sprouted either in boxes or similar vessels, or on benches, but in either case, good drainage must be supplied. Take the grain that it is desired to sprout; put it into a bag; put sufficient water into a barrel so that the bag of grain may be immersed; allow the grain to soak for twenty-four hours; then hang up the bag for twenty-four hours to drain and heat, empty the grain into a pile and water, if the room is very cold the grain may be covered loosely with a bag to allow it to heat. The grain should be turned, loosened up, and thoroughly washed at least once a day.

Where a sloping bench is used, the grain is started at one end and the sprouted grain removed from the other. Each day as the grain is turned and shaken up it is moved along the bench. A movable board is used to separate the different lots, and as the grain becomes more bulky, more space is allowed. In this way a continuous supply is being worked over the bench. The method is simple, requires no expensive installation, and the minimum amount of labour.

ANIMAL FOODS

When fowls are confined it is necessary to provide in some form animal food to take the place of the grubs and insects which they pick up when on range.

Fresh meat.—Fresh meat is perhaps the most relished form of animal feed, but there is often difficulty in securing it at a sufficiently low price to warrant its use. Horse flesh is available in some sections and makes excellent feed. Packing-house products, such as livers (see table 1) make the finest of feed and are valuable not only for feeding for heavy egg production, but for feeding the breeding stock.

Green cut bone.—Green cut bone is usually prepared from bones as secured from butchers' shops. These, generally with more or less meat attached, are run through a machine and cut into fine shavings. Fowls eat this ravenously, and care must be used at the start to see that they are not fed too much of it, as it will cause diarrhoea. It is valuable for the production of eggs, but caution is required in feeding it to breeding stock, as it may adversely affect both the fertility and the hatchability of the eggs. As cut bone heats very rapidly, it is impossible to use it except in very cold weather, or where a fresh supply for each feed is obtainable.

Other meat feeds.—Beef scrap, meat meal, blood meal, and other like preparations are by-products from the abattoirs and packing-houses. Some of these are excellent feeds, and on account of their keeping qualities and convenience for feeding, are more extensively used by poultry keepers than any other form of animal food. On the other hand, some of the brands offered are absolutely unfit to feed to poultry, and are suitable only for use as fertilizer. Before purchasing any of these feeds, poultry keepers should pay attention not only to their analysis, which varies greatly, but to their suitability for feeding. With a little experience, it is possible to tell at a glance whether the brand is suitable for feed or not, but if in doubt, pour a little boiling water on a sample, and the smell arising should settle the matter even with the inexperienced. If the odour is foetid the sample is unfit for food. Even when good, discretion is necessary in feeding them, as they are very concentrated and, if fed too heavily, are liable to cause digestive disturbances.

Fish scrap.—Fish scrap is used to a limited extent, and some think very highly of it, but it is generally fed because of a scarcity of beef scrap, not because it is preferred to it. It is more popular in the feeding of waterfowl, where the eggs are to be used for hatching purposes, than it is for feeding laying hens. Unless care is taken, there is liable to be trouble on account of bad-flavoured eggs, but if a suitable brand of scrap is used, and it is not too heavily fed, there should be no trouble.

Milk.—Milk in its various forms is highly valuable for all kinds of poultry. It may be used either as a drink, or to mix the mash. Buttermilk is very highly thought of, and rightly so, many claiming that it is not only an excellent food in itself, but is also valuable to stimulate digestion and keep the birds in a good, healthy condition. It has been found more satisfactory to feed milk either always sour or always sweet, rather than sour one time and sweet the next, as, fed in the latter manner, it is liable to cause bowel disturbance. Milk produces quality, whether in the growing stock, the laying pen, or the fattening crate, and, where milk-fed chicks have once been marketed, consumers will always ask for them.

Cottage cheese.—Where an abundance of milk is available it may be used in the form of cottage cheese, which is greedily eaten by all kinds of poultry. This is prepared by allowing the milk to sour until it becomes thick. A gentle heat is then applied, which will cause the whey to separate from the curd. The whey is then drained off and the "cottage cheese" remains. This may either be fed as it is or moved in the mash.

Eggs.—Eggs are sometimes fed. These are usually infertile eggs that are tested out of incubators. Where good, sound eggs are used, they are a valuable source of food, but if eggs in which the germ has started and afterwards dies are used, as they frequently are, it is necessary to use caution in feeding them, as they often produce bad results.

TABLE 2.—COMPOSITION AND DIGESTIBLE NUTRIENTS OF FEEDS

Foods	Protein		Carbohydrates		Fat		Nutritive Ratio	
	Total	Diges- tible	Total	Diges- tible	Total	Diges- tible	Total	Diges- tible
<i>Cereal</i>								
Wheat.....	11.9	8.9	71.9	62.6	2.1	1.1	1:6.4	1:7.3
Buckwheat screenings.....	11.9	.....	61.18	.....	2.53	.....	1:5.6	.....
Standard re-cleaned screenings.....	14.16	.....	58.63	.....	5.72	.....	1:5.0	.....
Wheat bran.....	15.4	11.0	53.9	24.79	4.0	1.48	1:4.0	1:2.5
Wheat shorts.....	14.9	12.2	56.8	50.0	4.5	3.8	1:4.4	1:4.8
Wheat middlings.....	15.6	12.8	60.4	53.0	4.0	3.4	1:4.4	1:4.7
Low-grade flour.....	18.0	8.2	63.3	62.7	3.9	0.9	1:4.0	1:7.8
Dark feeding flour.....	19.9	13.5	56.2	61.3	6.2	2.0	1:3.1	1:4.8
Stale bread.....	6.9	.....	44.2	.....	0.5	.....	1:6.6	.....
Corn (Flint and Dent).....	10.4	8.48	70.25	64.15	5.0	4.4	1:7.8	1:8.7
Corn meal.....	9.2	6.86	68.7	59.08	3.8	3.3	1:8.3	1:9.6
Corn bran.....	9.0	7.4	62.2	59.8	5.8	4.6	1:7.1	1:8.0
Gluten meal.....	29.3	25.8	46.4	43.3	11.8	11.0	1:2.4	1:2.6
Gluten feed.....	24.0	.....	51.2	.....	10.6	.....	1:3.1	.....
Hominy chops.....	9.8	7.5	64.5	55.2	8.3	6.8	1:8.4	1:9.4
Oats.....	11.8	8.4	59.7	53.78	5.0	4.39	1:6.0	1:4.2
Oat meal.....	14.7	11.5	67.4	52.1	7.1	5.9	1:5.6	1:5.6
Oat shorts.....	16.0	12.5	59.4	46.9	7.1	2.8	1:4.7	1:4.2
Buckwheat.....	10.0	5.9	64.5	56.1	2.2	1.96	1:6.9	1:10.2
Buckwheat middlings.....	28.9	22.0	41.9	33.4	7.1	5.4	1:2.0	1:2.0
Barley.....	12.4	9.58	69.8	59.39	1.8	1.22	1:5.9	1:6.4
Brewers grains (wet).....	5.4	3.9	12.5	9.3	1.6	1.4	1:2.9	1:3.1
Brewers grains (dried).....	19.9	15.7	51.7	36.3	5.6	5.1	1:3.2	1:3
Malt sprouts.....	23.2	18.6	48.5	37.1	1.7	1.7	1:2.2	1:2.2
Rye.....	10.6	7.0	72.5	62.85	1.7	0.38	1:7.2	1:9.1
Rice.....	7.4	4.8	79.2	72.2	0.4	0.3	1:10.8	1:15.3
Millet.....	11.8	7.36	57.4	56.47	4.0	3.42	1:5.6	1:8.7
Sunflower seed.....	16.3	12.1	21.4	20.8	21.2	29.0	1:4.2	1:7.1
Peas.....	20.2	17.57	51.1	43.33	1.2	0.96	1:2.6	1:2.6
Flaxseed.....	22.6	20.6	23.2	17.1	33.7	29.0	1:4.3	1:3.9
Linseed meal (old process).....	32.9	29.3	35.4	32.7	7.9	7.0	1:1.6	1:1.6
Linseed meal (new process).....	33.2	28.2	38.4	40.1	3.0	2.8	1:1.9	1:1.6
Cotton-seed meal.....	42.3	37.2	23.6	16.9	13.1	12.2	1:1.2	1:1.1
Sorghum.....	9.1	7.0	69.8	52.1	3.6	3.1	1:8.5	1:11.1
Kaffir corn.....	9.9	7.8	74.9	57.1	3.0	2.7	1:8.2	1:8.0
Soya bean.....	34.0	29.6	28.8	22.3	16.9	14.4	1:1.9	1:1.8
Broom corn.....	10.2	7.4	63.6	48.3	3.0	2.9	1:6.8	1:7.4
Rape (ground).....	31.2	25.2	30.0	23.7	9.6	7.5	1:1.6	1:1.6

TABLE 2.—COMPOSITION AND DIGESTIBLE NUTRIENTS OF FEEDS—*Concluded*

Foods	Protein		Carbohydrates		Fat		Nutritive Ratio	
	Total	Digestible	Total	Digestible	Total	Digestible	Total	Digestible
<i>Vegetable</i>								
Apples.....	0.7		16.6		0.4		1:25.0	
Artichoke.....	2.6	2.0	15.9	16.8	0.2	0.2	1:6.2	1:8.6
Beet tops.....	2.6	1.7	4.4	4.6	0.4	0.2	1:2.0	1:2.9
Beets (garden).....	1.5	1.2	8.0	8.8	0.1	0.1	1:5.4	1:7.5
Beets (sugar).....	1.8	1.1	9.8	10.2	1.1	1.1	1:5.5	1:9.4
Beets (mangel).....	1.4	1.1	5.5	5.4	0.2	0.1	1:4.2	1:5.1
Cabbage.....	2.4	1.8	3.9	8.2	0.4	0.4	1:2.0	1:5.0
Carrot.....	1.1	0.8	7.6	7.8	0.4	0.2	1:7.7	1:10.0
Parsnips.....	1.6	1.6	10.2	11.2	0.2	0.2	1:6.6	1:7.2
Potato.....	2.1	0.9	17.3	14.6	0.1	0.1	1:8.3	1:14.9
Pumpkin (field).....	1.3	1.0	5.2	5.8	0.4	0.3	1:4.6	1:6.4
Turnip.....	1.1	1.0	6.2	7.2	0.2	0.2	1:6.0	1:7.6
Sprouted oats.....	4.7		32.5		1.5		1:2.6	
Silage (corn).....	1.7	0.9	11.0	11.3	0.8	0.7	1:7.5	1:14.2
Silage (clover).....	4.2	2.0	11.6	13.5	1.2	1.0	1:3.4	1:7.8
Rape.....	2.3	1.5	8.4	8.1	0.5	0.2	1:4.1	1:5.6
Alfalfa (green).....	4.8	3.9	12.3	12.7	1.0	0.5	1:3.0	1:3.8
Clover (green).....	3.8	2.6	10.9	1.5	0.9	0.3	1:3.4	1:0.8
Barley fodder.....	2.7	1.9	8.0	10.2	0.6	0.4	1:3.4	1:5.8
Green corn fodder.....	1.8	1.0	12.2	11.6	0.5	0.4	1:7.3	1:12.5
Oats, fodder.....	3.4	2.6	19.3	18.9	1.4	1.0	1:6.6	1:8.1
Rye, fodder.....	2.6	2.1	6.8	14.1	0.6	0.4	1:3.1	1:7.1
Lawn clippings (green).....	2.3		13.8		1.0		1:6.9	
Alfalfa hay.....	14.3	11.0	42.7	39.6	2.2	1.2	1:3.3	1:3.8
Clover hay.....	13.2	8.5	37.3	37.4	3.4	1.5	1:3.4	1:4.7
Rowen (mixed).....	11.6	7.9	39.4	40.1	3.1	1.5	1:3.9	1:5.4
<i>Animal</i>								
Green cut bone.....	22.3				16.5		1:0.7	
Meat scraps.....	71.2	65.9	0.3		13.7	13.01	1:0.4	1:0.4
Blood meal.....	84.4	52.3	0.0	0.0	2.5	2.5	1:0.03	1:1.1
Dried fish.....	48.4	44.1	0.0	0.0	11.6	10.3	1:0.5	1:0.5
Fresh fish.....	10.5		0.0		2.5		1:0.5	
Milk (fresh and whole).....	3.6	3.6	4.9	4.9	3.7	3.7	1:3.6	1:3.6
Milk (skimmed).....	3.2	3.0	5.0	4.95	0.6	0.55	1:1.9	1:2.0
Buttermilk.....	4.0	3.9	4.0	4.0	1.1	1.1	1:1.6	1:1.6
Whey.....	0.6	0.8	5.1	4.7	0.1	0.3	1:8.8	1:6.6
Milk albumin.....	13.9	78.6	50.9	8.6	3.0	0.5	1:4.1	1:0.1
Eggs (hen).....	11.9				9.3		1:1.8	
Eggs (duck).....	12.1				12.5		1:2.3	

NOTE.—Data taken from Henry's Feeds and Feeding.—Eartlett, Maine, Bulletin No. 184.—Jaffa California Bulletin No. 164.

In some cases the digestible coefficients appear higher than the composition as determined by chemical analysis; this is probably due to a difference in the samples analyzed.

In highly concentrated feeds there is often a considerable variation in the composition of different samples so that it is always advisable to buy and to feed according to a guaranteed analysis.

MINERAL FOODS

As a considerable percentage of the dry matter in both egg and fowl is composed of mineral elements, it is evident that with a rapidly growing bird or with a fowl that is producing a large number of eggs, the demand for food containing these elements will be urgent. Under free range conditions, these mineral elements will be largely obtained through the ordinary feeds, and the green food, grubs, and grit that are picked up on the range. When fowls are more or less closely confined, it becomes necessary to supply the mineral foods, and the question of the most suitable form in which they can be obtained becomes important. Besides what is supplied through the feeding of alfalfa, clovers, bran, and other ordinary feeds, it is necessary to feed something that contains these elements in such quantities and condition that they can be

assimilated more freely. Bones, shells, grit and charcoal are the feeds that are generally used to supply these requirements.

Bones.—It has already been stated that green cut bone is one of the best forms of animal food. It is also excellent to supply mineral elements. Bone meal or granulated bone is also used for this purpose, the granulated form being usually fed in hoppers, and the meal fed in the mash.

Shells.—Shells of various kinds are used largely, but by far the most popular are oyster shells. These are crushed and separated into various sizes, according to the purpose for which they are intended. When fowls are laying heavily they will consume large quantities of shell.

Grit.—Commercial grit is made by crushing rocks of various kinds into sizes suitable for the different classes of fowl. Its chief function is to assist in the grinding of the food in the gizzard, but, undoubtedly, some of the mineral elements are assimilated.

Charcoal.—Charcoal is being used much more at present than formerly. It is inexpensive, and as the fowls will eat considerable quantities of it when available, it is well to supply it at all times. A hopper of the granulated size should be kept constantly before the flock, so that they may help themselves when they are so inclined. It is doubtful if there is much nutriment in it, but it is valuable as a corrective for digestive and bowel disorders and it probably supplies a certain amount of mineral matter.

TABLE 3.—MINERAL SALTS IN FEEDING STUFFS
AVERAGE CONTENT IN 1,000 PARTS OF FRESH OR AIR-DRIED SUBSTANCE

Feeding Stuffs	Water	Ash	Potash	Sodium	Lime	Magnesia	Phosphoric acid	Sulphuric acid	Silicic acid	Chlorin
<i>Green Forage</i>										
Meadow crops in bloom...	750	20.3	5.8	0.6	2.7	1.2	1.2	0.9	7.9	1.0
Rich pasture.....	780	21.5	8.7	0.3	2.5	1.1	1.9	0.7	3.4	1.7
Grass, young and second crop.....	800	18.0	5.3	0.7	1.6	1.2	1.4	0.9	4.6	1.0
Feed rye.....	760	16.3	6.3	0.1	1.2	0.5	2.4	0.2	5.2	0.6
Oats, green.....	810	14.2	5.6	0.5	0.9	0.4	1.3	0.5	4.4	0.6
Grains in bloom.....	785	15.0	4.4	0.3	0.9	0.4	1.4	0.4	6.2	0.6
Alfalfa, beginning bloom...	740	17.0	3.0	0.3	7.8	0.9	2.0	1.1	1.8	0.7
Red clover, very young...	860	13.8	4.9	0.3	3.9	1.2	1.6	0.3	0.4	0.5
Red clover, in bud.....	890	13.1	4.8	0.2	3.9	1.4	1.3	0.3	0.3	0.4
Red clover, in bloom.....	800	13.7	4.4	0.2	4.7	1.5	1.3	0.4	0.3	0.4
White clover, bloom.....	890	14.2	3.0	0.8	3.5	1.1	1.8	0.8	0.6	0.6
Peas, green.....	815	13.9	5.2	0.5	3.5	1.4	1.5	1.1	0.2	0.4
Rape, beginning of bloom...	870	10.5	3.5	0.4	2.3	0.4	1.2	1.5	0.5	0.8
Buckwheat in bloom.....	850	12.4	3.8	0.3	5.0	1.6	0.8	0.5	0.1	0.1
<i>Leaves and tops of root crops—</i>										
Field beets.....	905	13.0	2.5	3.5	1.6	1.4	0.8	0.8	0.5	2.5
Sugar beets.....	800	16.0	3.5	3.0	1.5	1.1	1.0	0.5	0.8	1.0
Turnips.....	890	12.0	2.9	1.1	3.9	0.5	0.9	1.1	0.5	1.2
Kohiraio.....	880	19.6	2.8	0.8	6.5	0.8	2.0	2.3	2.1	1.5
Carrots.....	890	20.5	2.5	2.0	7.9	0.8	1.0	1.8	2.4	1.5
Artichokes.....	800	14.5	3.1	0.2	5.0	1.3	0.7	0.2	3.6	0.4
Potatoes, nearly mature	770	20.5	4.5	0.9	6.4	3.3	1.6	1.3	0.9	1.5
<i>Hay</i>										
Meadow hay.....	140	70.0	20.0	2.2	9.5	4.0	4.3	3.0	27.2	4.0
Second growth.....	150	76.0	22.3	3.0	7.0	5.0	5.9	4.0	19.4	4.5
Rich pasture.....	150	84.0	34.0	1.3	10.0	4.6	7.5	2.6	16.0	8.0
Cereals, in bloom.....	150	59.4	19.3	1.0	3.4	1.7	5.6	1.5	24.7	2.3
Alfalfa, beginning bloom...	160	63.0	15.0	1.1	25.2	3.1	6.5	3.6	5.0	2.5
Red clover, very young...	160	78.0	25.5	1.9	23.5	7.6	10.0	1.8	2.5	3.3
Red clover, in bud.....	160	63.0	20.5	1.4	20.7	7.6	6.9	1.7	1.8	2.4
Red clover, in bloom.....	160	54.0	15.0	1.1	20.1	6.3	5.6	1.9	1.6	2.2
Red clover, mature.....	150	46.5	12.0	1.4	15.8	6.9	4.4	1.4	3.0	1.3
Sand vetch, beginning bloom.....	160	69.0	20.0	0.8	18.1	5.7	9.7	4.3	7.3	2.5
White clover in bloom...	160	61.0	13.0	4.4	18.4	5.8	7.8	4.5	2.7	2.6
Vetches, green in bloom...	160	45.5	10.0	2.4	16.3	4.6	6.2	3.4	1.1	1.4
Peas, green.....	160	50.5	20.0	2.3	15.6	6.3	6.8	5.1	0.8	2.0
Rape, beginning bloom...	160	68.0	22.6	2.3	15.0	2.7	7.6	9.5	3.2	5.0
Buckwheat, in bloom.....	160	69.1	21.4	1.6	27.9	9.2	4.2	2.5	0.8	0.5

TABLE 3.—MINERAL SALTS IN FEEDING STUFFS—*Concluded*
AVERAGE CONTENT IN 1,000 PARTS OF FRESH OR AIR-DRIED SUBSTANCE

Feeding Stuffs	Water	Ash	Potash	Sodium	Lime	Magnesia	Phosphoric acid	Sulphuric acid	Silicic acid	Chlorin
<i>Root Crops</i>										
Field beets.....	900	6.5	2.8	1.5	0.3	0.4	0.6	0.3	0.2	1.0
Sugar beets (new varieties rich in sugar).....	750	5.3	2.3	0.7	0.6	0.5	0.8	0.2	0.2	0.2
Turnips.....	920	6.4	2.9	0.6	0.7	0.2	0.8	0.7	0.1	0.3
Carrots.....	850	8.2	3.0	1.5	0.9	0.4	1.1	0.5	0.2	0.4
Artichokes.....	800	10.8	6.2	1.0	0.3	0.3	0.6	0.6	0.2	0.4
Potatoes.....	750	9.5	6.0	0.2	0.3	0.5	1.2	0.6	0.2	0.4
<i>Grains and Seeds</i>										
Winter rye.....	140	18.9	6.0	0.6	0.5	2.0	8.5	0.2	0.3	0.6
Summer rye.....	140	19.0	6.0	0.6	0.5	2.0	9.2	0.2	0.2	0.6
Summer wheat.....	140	19.9	6.0	0.5	0.5	2.2	8.5	0.2	0.3	0.5
Summer barley.....	140	25.5	7.0	1.0	0.6	2.0	8.0	0.4	6.0	1.5
Oats.....	140	26.5	5.0	0.5	1.0	1.3	7.0	0.5	10.5	0.5
Corn.....	140	12.8	3.7	0.1	0.3	1.9	5.7	0.1	0.3	0.2
Sorghum.....	140	16.0	3.3	0.5	0.2	3.4	8.1	0.1	1.2	0.1
Millet.....	110	29.5	3.3	0.4	0.2	2.8	6.5	0.1	15.6	0.1
Peas.....	140	27.5	12.5	0.2	1.1	1.9	10.0	0.8	0.2	0.4
Soy beans.....	100	28.3	12.6	0.3	1.7	2.5	10.4	0.8	0.1	0.1
Feed vetch.....	140	26.6	8.0	2.1	2.2	2.4	9.9	1.0	0.3	0.7
Rape.....	120	39.2	9.6	0.6	5.5	4.6	16.6	0.9	0.5	0.1
Hemp.....	120	46.3	9.4	0.4	10.9	2.6	16.9	0.1	5.5	0.1
Buckwheat.....	140	11.8	2.7	0.7	0.5	1.5	5.7	0.2	0.2	0.2
<i>Fruit</i>										
Apples, whole fruit.....	830	2.2	0.8	0.6	0.1	0.2	0.3	0.1	0.1	0.1
<i>Commercial Products and By-products</i>										
Wheat bran.....	130	53.5	15.3	0.3	1.5	9.0	26.9	0.2	0.2	0.1
Wheat, bread flour.....	120	11.2	3.5	0.1	0.6	1.4	5.6	0.1	0.1	0.1
Wheat, fine flour.....	130	4.4	1.5	0.1	0.3	0.4	2.2	0.1	0.1	0.1
Barley meal.....	140	20.0	5.8	0.5	0.6	2.7	9.5	0.6	0.1	0.1
Corn meal.....	140	5.9	1.7	0.2	0.4	0.9	2.7	0.1	0.1	0.1
Rice feed meal.....	100	54.7	6.1	1.2	1.2	9.5	23.8	0.2	10.3	0.1
Malt sprouts.....	120	67.7	20.8	1.2	1.9	1.9	18.2	2.7	14.9	4.7
Cottonseed cake.....	110	66.4	15.8	0.8	2.9	10.1	30.5	0.8	5.5	0.1
Linseed cake.....	120	51.3	12.5	0.8	4.3	8.1	16.2	1.7	6.4	0.4
Rapeseed cake.....	110	57.0	13.0	1.9	7.1	7.3	20.0	3.4	2.9	0.4
<i>Animal Products</i>										
Colostrum.....	730	11.8	0.9	0.7	4.1	0.2	3.3	0.1	0.1	1.3
Cow's milk.....	875	7.2	1.7	0.4	1.7	0.2	2.0	0.1	0.1	1.0
Skim milk.....	910	7.9	2.1	0.5	1.7	0.2	2.2	0.3	0.1	0.9
Whey (cow's milk).....	930	5.4	1.7	0.7	1.0	0.1	0.9	0.2	0.1	0.8
Tankage.....	115	15.9	0.9	0.5	3.6	0.6	6.9	0.2	0.1	0.3
May bugs (fresh).....	704	13.4	5.0	0.8	0.4	1.1	5.6	0.2	0.2	0.1
Ox blood.....	790	7.9	0.6	3.6	0.1	0.1	0.4	0.2	0.1	2.7
Oyster shell.....	527.8	.....	.....	.....	.....	.....	.....	.....	.....	.....
Clam shell.....	531.1	.....	.....	.....	.....	.....	.....	.....	.....	.....

NOTE.—All data in this table taken from Scientific Feeding of Domestic Animals by Klimmer, translated by Paul Fischer, except for oyster shell and clam shell which is from an analysis by the Dominion Chemist.

FEEDING METHODS

In feeding, regularity is essential no matter what method is followed.

There are many methods that give satisfactory results. What suits one feeder may not suit another, so that it is necessary for individual poultry keepers to decide for themselves just what system of feeding they will adopt. It will be found that best results are obtained where a certain amount of the grain fed is ground. This may be fed either as a moist mash or dry in hoppers according to the personal preference of the feeder.

THE HOPPER SYSTEM

The feeding of a dry mash in hoppers is very popular, especially on large plants where labour has to be considered. This system has some advantages and some disadvantages, but the former greatly overbalance the latter.

The principal disadvantage is the waste of feed by the scattering of it out of the hoppers. This can be largely avoided by the use of properly constructed hoppers or by the closing of the hoppers except at certain regular periods.

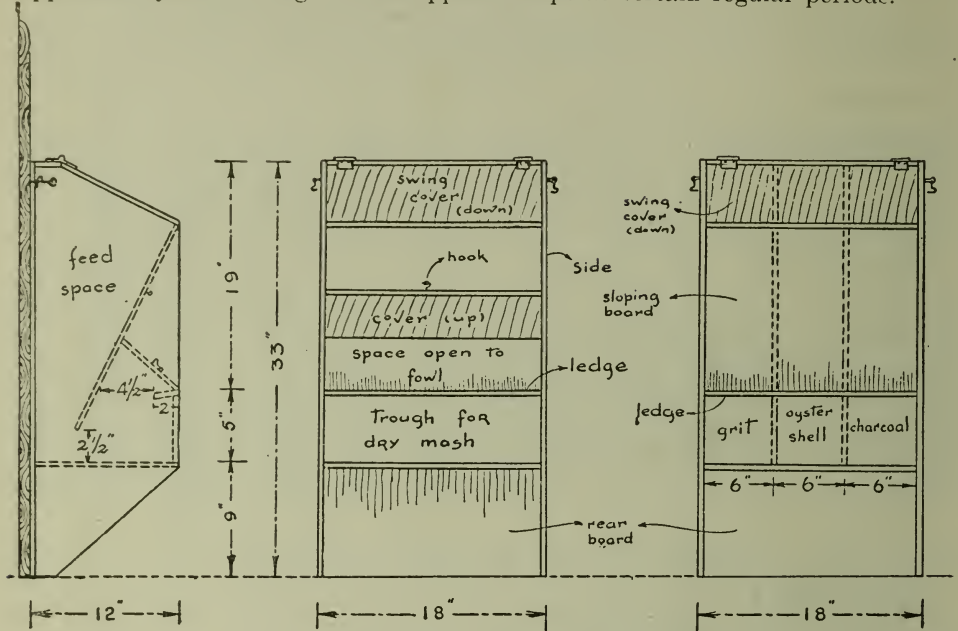


FIG. 3.—POULTRY-HOUSE HOPPER

Right—Front view of hopper with cover over feed-trough down.

Centre—Front view of hopper with feed-trough cover hooked up.

Left—End view of hopper. Grit hoppers require no cover over the troughs.

The chief advantages are: the saving of time necessary in the making of moist mashes; the lessening danger of over-feeding by novices, as the dry mash is less palatable than the moist; the possibility of feeding more sparingly with grain and so keeping the hens more active, as they prefer the grain to the dry mash and if fed sparingly will scratch as long as a kernel is to be found.

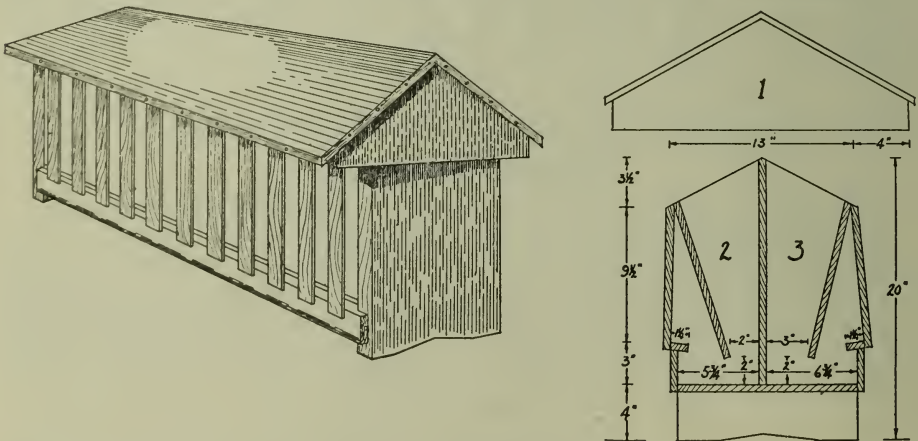


FIG. 4.—RANGE HOPPER

This type of hopper is in more or less favour. The middle partition is made movable so that the two compartments can be thrown into one.

THE MOIST-MASH SYSTEM

The feeding of a daily moist mash was formerly the favourite method among poultry keepers, and even yet many stick to this method in preference to the hopper system.

Some prefer feeding it in the morning, some at noon, and some at night. The time is really immaterial, and should depend on the convenience of the feeder.

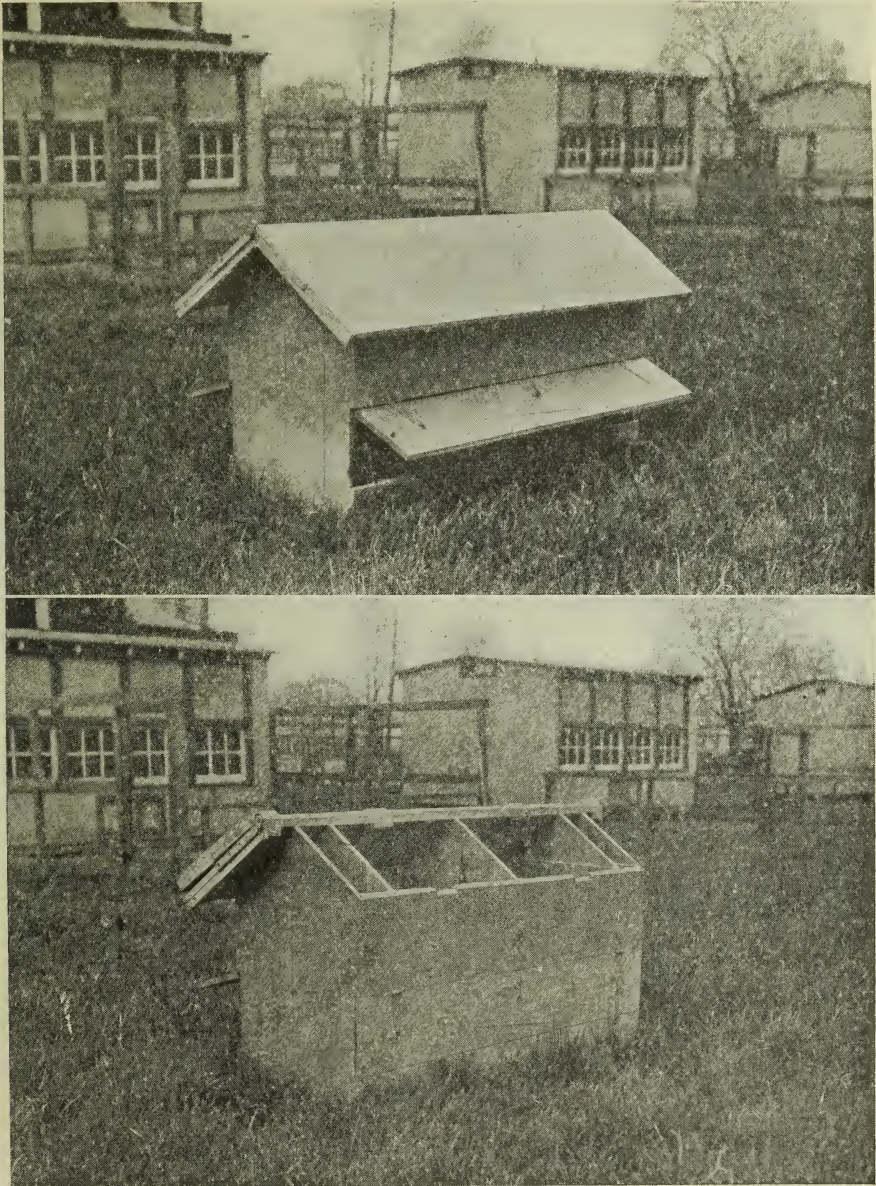


FIG. 5.—FIELD HOPPER

Above—Ready for use.

Below—With front closed and cover thrown back ready for filling.

Some of the disadvantages are that it takes more time and requires more regularity than the feeding in hoppers, and there is more danger of digestive disorders through overfeeding or through the feeding of improper mashes.

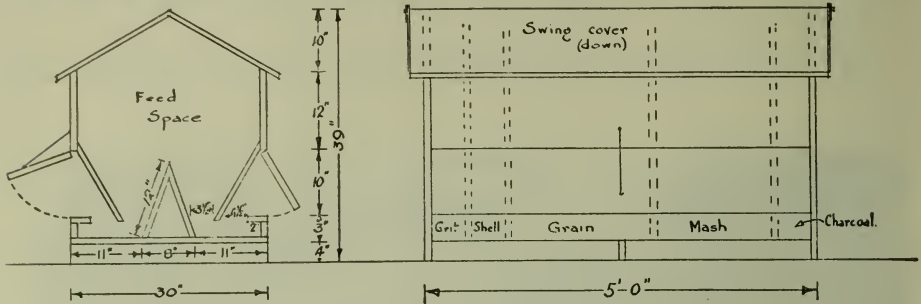


FIG. 6.—FIELD HOPPER

Front elevation and section of Field Hopper shown in Fig. 5. The top is covered with ready roofing. This stops short of the ridge over which is fastened, with cement paint, a strip of heavy canvas, thus making an absolutely water-tight cover.

Some of the advantages are that the feeding of a mash makes it convenient to use table scraps, vegetable parings, and other kitchen waste. It is more palatable than the dry mash, and it is a convenient way to get fowl to eat alfalfa or other similar feeds.

A combination of the two methods may be used to advantage, especially for the feeding of pullets for egg production.

RATIONS

From what has already been said it will be realized that dependence need not necessarily be placed on any given feeds. So long as it is borne in mind that the various forms of foods, cereal, vegetable, animal, and mineral, must be supplied, rations may differ widely in make-up. Farmers should depend largely on home-grown feeds, and when it is necessary to buy, those feeds most readily and cheaply obtainable in the various localities are the ones that should be used. A ration that proved satisfactory last year may be too expensive to use this season, or one that was too expensive last season may be cheapest this. The successful poultry keeper will not only vary the rations according to the prices of feeds, but also according to the condition of his flock. A hen that is not laying cannot stand as heavy a ration as one that is producing heavily, neither can a flock of old hens stand as heavy a ration as a flock of pullets.

The following rations have been used, and have proved satisfactory, and may be adopted or altered to suit conditions.

FOWL

Chicks.—A mistake that even a great many experienced poultrymen make is the feeding of the chicks too soon after hatching. When a chick leaves the shell it comes into the world with a sufficient supply of nourishment in the form of egg yolk to last it for several days. Therefore, what a chick requires at this stage of its existence is not feed, but warmth and rest.

When the chicks are removed to their brooding quarters there should be some coarse sand or fine grit and fine oyster shell scattered where they can have free access to it. They should then be left until they show positive signs of hunger, which will be from two to three days after hatching. The first care should be to see that digestion is properly established. To this end only light feeds should be used.

The chicks are fed five or six times a day, depending very largely on dry mash for the first few days, after which small quantities of chick scratch are scattered in the litter to keep them busy.

The chick mash used at the Dominion Experimental Farm, Ottawa, is made up of one part each of shorts, middlings, cornmeal and oat flour, one-half part fine meat meal and a little fine table salt about $\frac{1}{2}$ to $\frac{3}{4}$ of one per cent. If there is no bone in the meat meal five per cent bone meal is substituted for an equal amount of the meat meal.

Whenever mash is fed, a little coarse sand, grit or oyster shell is scattered on the feeding boards so that the chicks may be assured of sufficient supply until such times as they learn to go to the hoppers for it.

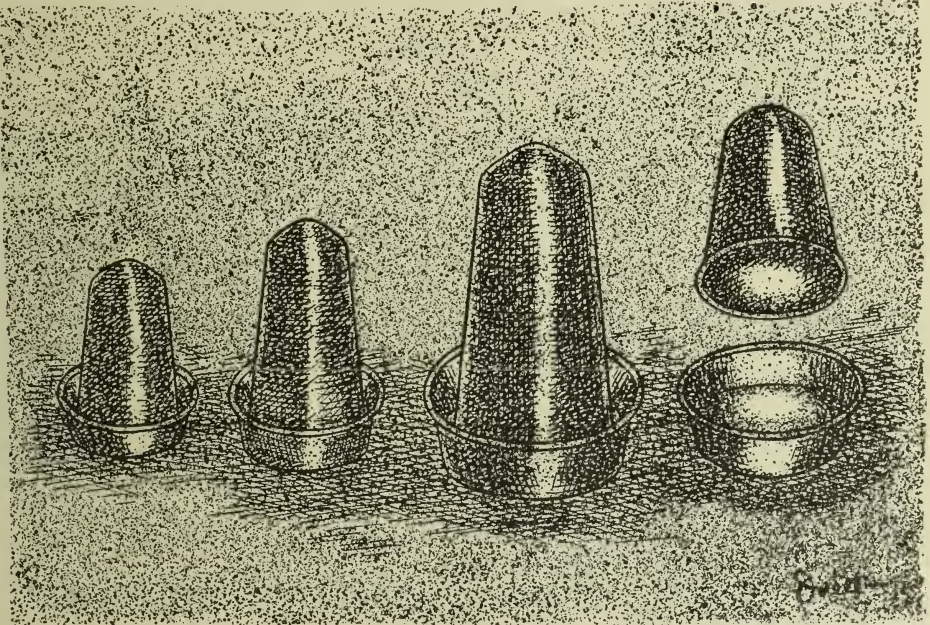


FIG. 7.—DRINKING FOUNTAINS

Fountains should be of simple construction so that they may be readily cleaned. Those shown are so simple that explanations are unnecessary. They are made in various sizes for chicks, fowl, or ducks. An empty tomato or similar can, with a couple of holes punched in the sides near the top, inverted in a saucer makes a first-class chick fountain.

Fountains of milk and water (Fig. 7), which should be renewed often, are kept before the flock at all times, also hoppers of grit, oyster shell and charcoal and as soon as they become accustomed to the hoppers, hoppers of dry mash are also supplied.

For green feed, give the chicks clover sod to tear at; if this is not available, sprouted oats or some similar feed should be supplied.

After the first week or ten days, moist mash may be supplied, using infertile eggs, shells and all, or raw liver run through a meat chopper, or milk and cod-liver oil—all dried off with the dry mash mixture, the egg mash being gradually replaced by mash moistened with milk.

When rapid maturity is desired, the moist mashes may be kept up after the chicks are put on range, otherwise they are discontinued. Where moist mash is being fed, only what will be cleaned up in a few minutes should be given and if at any time too much should be fed, the surplus should be removed, as nothing will put chicks off their feed quicker than stale, sour mash.

An ideal range for chicks is a clover field beside a corn field or an orchard, where they can get all the succulent green feed and grubs they can eat and still have shade as required. Given these conditions, once the chicks go on to range they can be reared with very little labour, dependence being placed largely on hopper feeding.

Laying pullets.—When pullets are put into laying quarters off range, where they have had an abundance and variety of green feed with unlimited fresh air, housing conditions should be made to resemble range conditions as much as possible, all changes being made gradually.

Where it is simply a matter of getting the most eggs possible out of the pullets, artificial lights may be used to advantage. Where pullets are being forced through the winter for greatest production and sold when this period is past, lights are used more extensively and a heavier-forcing meat ration is given.

The following method may be followed where pullets are being kept for a first year's egg record, and where selected pullets are used for breeding purposes and are held over for future breeders. Grit, oyster shell, charcoal and dry mash are kept in hoppers constantly before the flock. Fresh water, and when possible a dish of sour milk, is also supplied. In the morning a light feed, and in the evening a full feed of mixed scratch grain is given in the litter.

For green feed, alfalfa or clover hay is constantly supplied and sprouted oats or roots are given daily. If mangels are used they are stuck on nails and the hens pick them as they desire. If carrots or turnips are used, they are pulped and mixed in a moist mash. Additional animal feed, such as green cut bone or raw liver, is put in the moist mash, using about one-half ounce per bird. The liver is run through a meat cutter and dried off with the dry mash mixture. The birds are fed just what they will clean up in a few minutes.

A good dry mash mixture may be made of equal parts of bran, middlings, corn chop and oatflour or finely ground oats and half part meat meal. To this add about 1 per cent fine table salt, and where green cut bone is not being used, about 5 per cent bone meal.

A good scratch grain may consist of about equal parts of corn and wheat and a half part of good, plump oats.

Commercial scratch mixtures usually contain a number of other grains to add variety and appearance to the mixture, but this mixture will prove satisfactory.

The feeder should handle his birds to note their condition. If they are losing weight the amount of scratch grain fed should be increased. If they are inclined to put on fat, reduce the grain. Generally speaking, the higher the percentage of mash consumption, the greater will be the egg production. However, care must be exercised to keep a proper balance between the consumption of mash and the consumption of grain, for if production is stimulated by an over-consumption of mash to the extent of gradually reducing the bird in flesh, there is bound to be a consequent "break" in production.

With the ration described there should be no trouble through pullets "going off their legs." Should any tendency of the kind be noted, give an occasional feed of cod-liver oil in the mash.

Stock Birds.—The breeders should be fed a varied non-stimulating ration—a ration very similar to that fed the laying pullets, except that less meat is fed and the mash mixture is either made more bulky or the hoppers closed for part of the day. Alfalfa or clover hay should be before the flock at all times. Bulk may be added to the mash by the addition of alfalfa meal to the mixture. As with the pullets, grit, oyster shell, charcoal, dry mash, and water are kept before the flock at all times. A light feed of scratch grain is fed in the morning and a full feed at night. Green feed in variety is supplied and as breeding time approaches and production is wanted, a little raw liver is added to the

ration. Keep the breeders active, do not allow them to become overfat. When the hens are laying well an occasional feed of cod-liver oil in the mash will do no harm; in fact, vitality in the germs seems stronger where it is used.

Fattening or Crate Feeding.*—In crate feeding, the use of sour milk is indispensable where high quality is an object. The milk is mixed with finely-ground grain in about the proportion of three pounds of milk to two of grain. This makes a rather thin mash. The birds are fed all they will eat twice a day, at regular intervals, and any food that is left is removed immediately, so as to keep the appetite keen. It is customary to mix a mash a feed ahead so that fermentation may begin before it is fed.

The grains most commonly used are corn, oats, barley and buckwheat, or some of their by-products, but whatever is used should be finely ground. Corn produces a yellow fat, so that, where white skin is in demand, it is advisable to use it with caution. A mixture that will be found to give satisfactory results consists of equal parts of corn, oats and buckwheat.

From experiments conducted at the Central Farm it was shown that "buckwheat screenings" give excellent results. This is a by-product from the elevators, and is composed largely of the seeds of "Wild buckwheat" and shrunk wheat, although there is also a proportion of other seeds. This feed is usually cheap, and as it is palatable and gives such excellent results, it is highly recommended. It is fed mixed with sour milk in the usual manner.**

TURKEYS***

Domestic turkeys partake largely of the habits of their wild ancestors, and if they are given as much opportunity as possible to gratify their wild instincts, such as ranging over unlimited areas in search of their food, and roosting in whatever sheltered tree or nook they may select, there will be a minimum mortality. Kept under such conditions it will be found that the poults will be very little more difficult to rear than chickens.

Poults.—The poults are started in the same manner as the chicks; that is, they are given a feed of coarse sand or fine grit and fine oyster shell before any feed is supplied. A dish of sour milk is placed where they can help themselves. Do not be anxious to get the poults eating too soon, a couple of days after hatching will be soon enough.

When raising the poults by artificial methods, sometimes a little difficulty is experienced in getting them to start feeding. In such cases, a feed of sour milk may be administered with a medicine dropper, or if a little feed is held in the hand where the poult has to reach for it, it will take it more readily than if it has to pick it off the ground.

For the first feed, after the sour milk is given, bread crumbs moistened with milk, or bread crumbs mixed with egg may be used. This is gradually changed by adding some of the chick mash previously recommended and chopped onion tops, dandelions or any succulent green feeds. They are fed just what they will clean up quickly. Particular care is taken to see that no feed is left lying around and the poults and chickens are not fed together, as this is one of the ways in which "blackhead" is readily spread.

As soon as the poults are strong enough they are allowed to range.

On Range.—The wider the range the less necessity for supplementary feeding. A light feed of mash may be given in the morning, and grain at night, the quantity depending on the avidity with which it is eaten.

Fattening.—Turkeys that have been on good range require very little fattening. For two to three weeks before killing they are fed all they will consume of ground grains mixed with sour milk, with an occasional feed of corn as a change, being brought on to full feed gradually.

* See Experimental Farm Bulletin No. 88, pp. 24-29.

** See Experimental Farm report for 1914, pp. 669-973 for details of these experiments.

*** See Experimental Farm Bulletin, No. 46, New Series.

Stock birds.—In feeding the breeders during the winter, the great danger is in getting them too fat. Dependence should be placed largely on alfalfa or clover hay and scratch grain. The scratch grain should be fed sparingly and always in a deep litter so that the birds will have to work for all they get. Grit, oyster shell and either water or snow should be always available. As

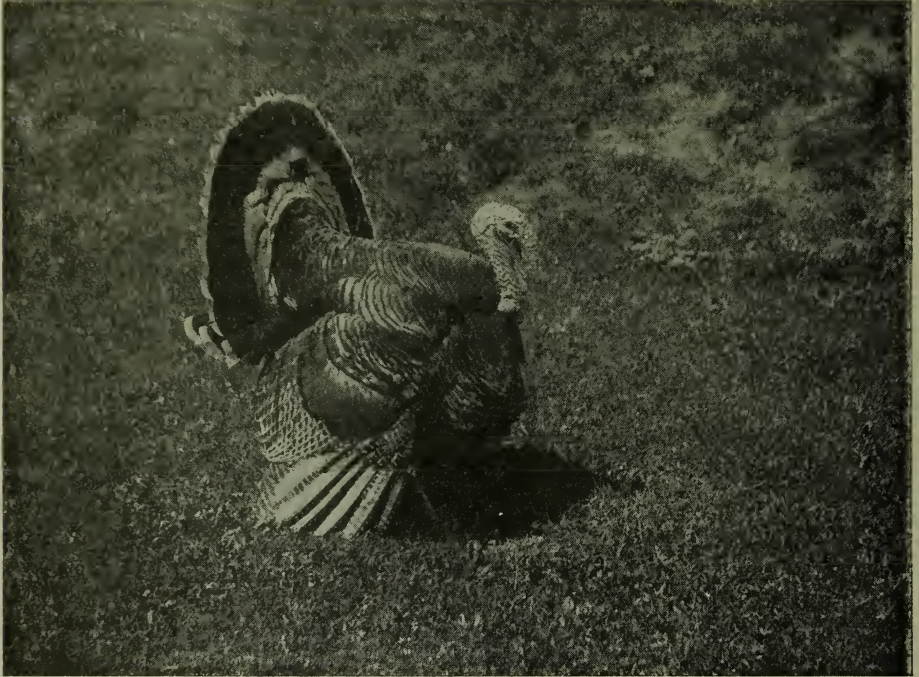


FIG. 8.—HIS MAJESTY—THE KING OF TABLE BIRDS



FIG. 9.—ON FREE RANGE—THE PLACE TO RAISE GOOD VIGOROUS STOCK

the time that eggs are wanted approaches, the rations are gradually increased until they are similar to that recommended for ordinary fowl stock birds.

GUINEA AND PEA-FOWL

Guinea and pea-fowl, and birds of similar nature, are handled in the same manner as turkeys, and the ration suitable for the one is equally suitable for the others.

DUCKS

Ducks are voracious feeders, and it is necessary to supply roughage in the form of green food, hay or roots, liberally. Otherwise, if they are fed generously not only will the keeping cost be too high, but they will become too fat to reproduce properly.

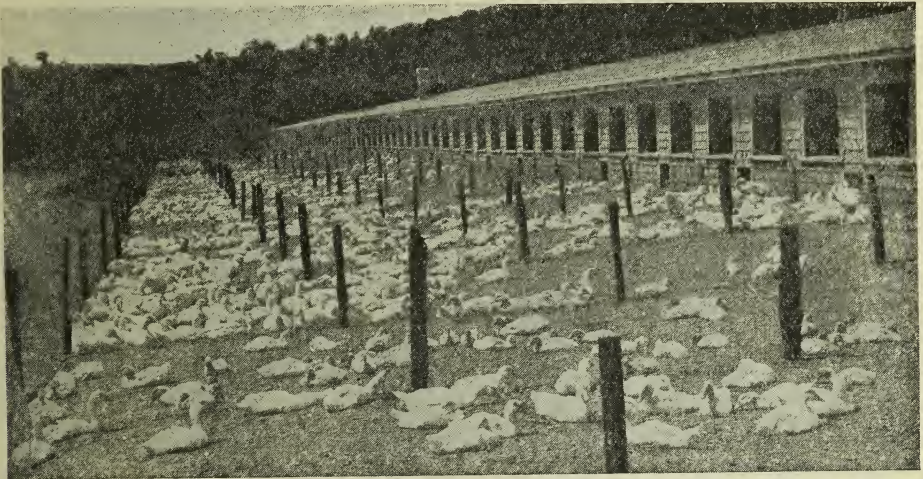


FIG. 10.—SCENE AT BROME LAKE DUCK FARM, KNOWLTON, QUE., WHERE 20,000 TO 30,000 DUCKS ARE RAISED ANNUALLY

If ducks are on grass range they will thrive on any ration that is suitable for ordinary fowls, but for profitable production it is advisable to feed largely on coarse, bulky feeds.

Ducklings.—When the ducklings are about thirty-six hours old they are given feed and water. The feed consists of stale bread soaked in milk and dried off with a mash composed of equal parts bran, shorts, and corn meal, and 5 per cent coarse sand. For the first few days the feed is kept before them all the time, but it is changed so as not to become stale. After two days they are fed regularly four or five times a day just what they will clean up, and any that is left is removed. If milk is not available, the bread is soaked in water, in which case 5 per cent of beef scrap is added. The bread is gradually reduced, and by the time the ducklings are ten days old it is dropped entirely, and the same mash is continued, with the exception that the meat scrap is increased to 10 per cent. A little tender green food is put in the mash after the first couple of days. This is gradually increased until there is as large a proportion of green food used as the ducklings will clean up; this will amount to from 20 to 30 per cent in bulk by the time the ducklings are a couple of weeks old. If an inclination to pick out the grain part of the mash and leave the green food is noticed, the proportion of green is reduced.

This ration is continued for six or seven weeks, when the flock is separated, those ducks reserved for stock purposes are given a large run where they will have free access to a stream and where they will forage for most of their feed; those intended for market are placed in the fattening pens without range or water to swim in, and fed three times a day.

Fattening.—For fattening, the proportion of corn is increased and the bran and green food reduced. The feed at this time consists of 1 part bran, 2 parts shorts, 3 parts corn chop, 10 per cent beef scrap, about 5 per cent sand, and the green food is reduced to about half what the birds have been consuming previously. This mash is moistened to a crumbly state with milk, and an abundance of water is kept before the flock at feeding time. The ducks are marketed at eight to ten weeks of age.

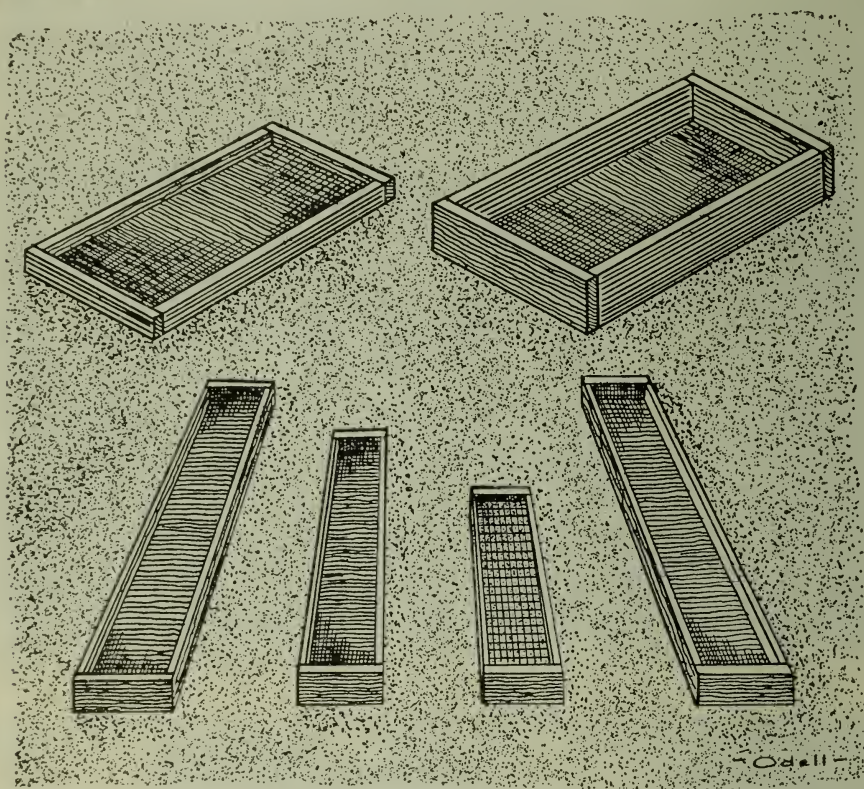


FIG. 11.—SIMPLE TROUGHS

This type of trough has been found very useful.

Those on the top which are made out of 10" or 12" boards about 12" or 15" long are convenient for feeding mash to chicks or hens. For chicks a strip about $1\frac{1}{2}$ " high is nailed around the board, for hens a strip 3" or 4" wide is used.

Those on the bottom row are similar except that they are made long. They are used for duck feeding. The third trough from the left illustrates how the same type of trough may be arranged for feeding chicks dry mash. A strip of $\frac{1}{2}$ "-mesh wire is laid over the feed to prevent the chicks from scratching it out.

Stock ducks.—After ducks intended for breeders are separated from the market stock at six or seven weeks of age, they are given a light feed in the morning and a full feed at night of the following mash; bran 3 parts, shorts 2 parts, corn chop 1 part, with 5 per cent beef scrap and 5 per cent sand, and as much green feed as they will eat. One of the feeds, or at least a part of it, should consist of mixed grains, principally oats and barley. If the range is good, the morning feed is omitted altogether. They are continued on this ration until a few weeks before eggs are wanted, when they are given a mash consisting of 4 parts corn chop, 2 parts bran, 2 parts middlings, 1 part meat scrap, 5 per cent sand, equal parts of either boiled or finely pulped vegetables, and of cut clover as much as they will consume. The mixed grain is also continued.

Changes from one ration to another are made gradually, and rations are varied according to conditions.

GEESE

Geese, like ducks, require a large proportion of roughage in the ration. This is best supplied in winter by the use of clover hay and roots, and in summer by grass. Given the range of a good pasture, a flock of geese require little else unless it is desired to force rapid growth.

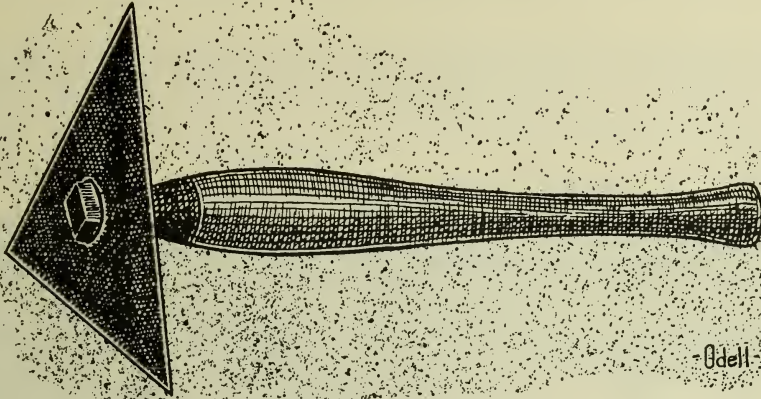


FIG. 12.—A CONVENIENT TOOL

A scraper similar to that shown in the illustration will be found to be very convenient for cleaning out troughs and doing similar work.

Goslings.—Goslings require warmth and rest the first day, and it is advisable to leave them undisturbed. On the second day they should be placed where they will have free access to a plot of tender grass, otherwise they should



FIG. 13.—A PAIR OF BREEDERS. CANADA (WILD) GEESE AT THE CENTRAL EXPERIMENTAL FARM

be supplied with all the succulent green food they will eat, together with mash fed them three times a day. The feeds recommended for ducklings are equally suitable for goslings. If it is intended to market the goslings as green geese, it is advisable to feed them mash heavily from the start. If they are intended for stock purposes, it is better, as soon as the goslings get strength enough, that they be allowed freedom to range on the pasture lands, where they will pick up most of their feed, requiring only a light feed of mash in the morning and grain at night.



FIG. 14.—STOCK DUCKS ON RANGE AT THE CENTRAL EXPERIMENTAL FARM
An ideal place to raise the Breeders.

Fattening.—At six or seven weeks of age, goslings that have been forced from the very start are put on a ration similar to the one recommended for fattening ducks.

Where geese have been kept on pasture all summer, they are penned in the fall and fed heavily on mash feed composed of whatever grains are most available (corn being in especial favour for this purpose), and an occasional feed of whole grain to whet the appetite.

The fattening period usually lasts from three to four weeks.

Stock geese.—After the breeding season the geese on range may practically subsist on the pasturage. If the grass gets short or dried up, it may be supplemented with mash or green feed, but so long as there is good pasturage no other feed is necessary.

During the winter, the breeders should be fed all the clover or alfalfa hay and roots they will eat, but grain should be fed sparingly (just a light feed morning and night), dependence being placed largely on the coarse grains like oats and barley. As laying time approaches, a light mash may be added, and when in full lay, the mash feed may be increased.



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OTHER POULTRY PUBLICATIONS

The following list comprises the publications on poultry that are available at the Publications Branch, Department of Agriculture, Ottawa:

Avian Tuberculosis	Bul. 18, H. of A.B.
Chicks, Brooding and Rearing.....	Cir. 35, N.S.
Crate Feeding	Ex. Cir. 70.
Duck Raising	Ex. Cir. 29.
Egg and Poultry Market Report. (Weekly).....	L.S.B.
Eggs, The Candling of	Pamp. 3, L.S.B.
Eggs, Candling Appliances for Electric Lamps	L.S.B.
Eggs, Candling Appliances for Kerosene Lamps	L.S.B.
Eggs, Lime Water for the Preservation of.....	Ex. Cir. 42.
Eggs, Notes on the Cold Storage of.....	Cir. 30, D. & C.S.B.
Eggs, Payment of According to Quality.....	Pamp. 6, L.S.B.
Eggs, in the Home, The Preserving of.....	Leaf. 4, L.S.B.
Eggs, Rules for Production and Marketing of New Laid....	Leaf. 1, L.S.B.
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Flocks, Manitoba Approved.....	Pamp. 25, N.S.
Geese, The Management of.....	Ex. Cir. 31.
House Construction, Principles of Poultry.....	Bul. 87, E.F.
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Incubation, Natural ..	Ex. Cir. 1, E.F.
Male Birds, Removal of, After Breeding Season.....	Leaf. 2, L.S.B.
Mites, How to Rid a Henhouse of.....	Ex. Cir. 85.
Pigeons ..	Bul. 15, N.S.
Poultry House, The Farmer's.....	Bul. 89, E.F.
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