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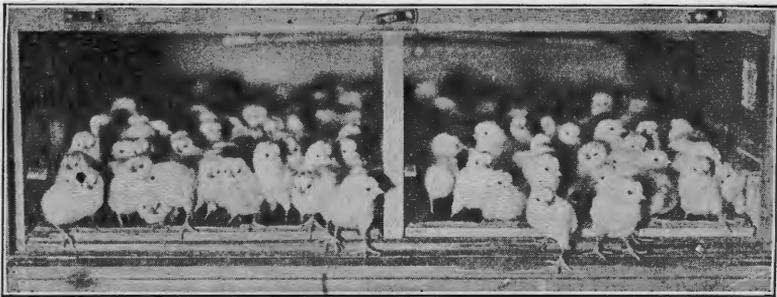
Principles and Practice of Poultry Feeding

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INTRODUCTION.

Poultry culture has become a recognized business or line of agriculture in our state. The installing of poultry plants at the Experiment Stations by the State College has put the business of the poultryman upon a plane impossible of its attainment in a like period of time in any other way. The production of market poultry and eggs, and of breeding stock has already grown to a business of considerable magnitude, within the brief period of a few years. The work of the Station poultry plants has thus far been chiefly along demonstration and educational lines. Our State Experiment Stations have given careful attention to the housing, selection and feeding of poultry. Our experiments and the experience of many successful poultrymen of the state have fully demonstrated that the poultryman's business can be made remunerative, as much if not more so than any other branch of farming.

Conditions Are Favorable. The poultry business does not require expensive buildings and equipment. In our state such outlay need not exceed one dollar per hen.

The climate is quite favorable to poultry culture, and under proper management poultry diseases may be kept to the minimum.

Practically all of the feeds required by poultry are being produced within this state.

Our markets for poultry and their products are unsurpassed; the local demand far exceeds the local supply. The shipments of poultry and eggs to Alaska markets is yearly increasing. Eggs and poultry are being shipped into this state from the middle west in increasing quantities year by year, and any prospect of the business being over done is very remote indeed.

FEEDING POULTRY.

This bulletin is devoted to the problems of feeding poultry for eggs, for meat or for both eggs and meat. The fundamental requirement for successful poultry production is fowls that possess in a marked degree stamina, health and vigor, which qualities are dependent upon the breeding, feeding and conditions of environment. In order that poultry culture be made to pay, scientific feeding becomes necessary in order that the birds be maintained and the eggs and meat produced at the lowest cost.

Conditions Under Nature. The natural time for reproduction among fowls is during the spring months when the grasses and weeds are tender, and the supply of insects, worms, shells and grits are most abundant. At such time the natural feeds contain in easily digestible form those materials required for the fowl's physical development, as

well as for the production of eggs. Later in the season the feeds stated become less plentiful and the plants become mature, hard and much less digestible. The plants go to seed and their poultry feeding value thereby becomes changed from a body and muscle builder food to a fattening food, the body's protection against winter weather conditions.

Increased Production Necessary. As the great value of poultry and their products for human consumption become better understood, the demand for the same soon becomes and still continues to be inadequate to meet the commercial needs. The demand for fresh poultry products has become more and more insistent until they are a recognized necessity for human consumption. Thus it was that an artificial system for supplying these products became necessary, owing to an exacting public demand. Not only must the fowls be improved upon both in quantity and quality, but their egg production must be changed from an annual yield of one dozen eggs per hen to that of twelve or fifteen dozens per hen, and thus secure practically a continuous supply of both poultry and fresh eggs. The conditions have greatly stimulated poultry production, which is fast developing into one of the leading lines of agriculture, until poultry culture has developed from a fad into a business for which fitness, study and experience are pre-requisites to success.

Strength and Vigor Essential. The fowl's body must first become developed into a healthy physical structure, possessing stamina and vigor. This in the strong born chick is to be accomplished through correct feeding and proper environment. The weak born is always a ne'er-do-well. Nature's provisions for the fowl's support, as stated, and the composition of the fowl's body and eggs, as determined by analysis made by the chemist, are the foundations upon which a system of scientific feeding has been developed, by and through which the business of poultry culture is fast being established throughout the country.

Chemical Compounds. Animal and vegetable matter is found on chemical analysis to, as a rule, contain five distinct types of chemical compounds, i. e., water, ash, protein, carbohydrates and fats.

THE COMPOSITION OF THE FOWL'S BODY.

Water. More than one-half of the gross weight of the mature hen is water.

Ash. That which is left of the hen's body after having been subjected to great heat is termed ash or mineral matter and constitutes about four per cent. of the entire weight of the body.

Protein. Is the most important element that enters into the composition of the hen's body, it being the base of all living tissue and constitutes about 22% of the same.

Fat. Is stored up materials over the hen's body to be drawn upon to supply the requirements of the body in the event of insufficient ma-

terials being present in the fowl's feeds. Under normal conditions about 18 per cent. of the fowl's body is fat, although the body of the fattened fowl contains more than 30 per cent. fat.

Composition of the Egg. Egg yolk—water, 53%; protein, 16%; fat, 30%. Egg white—water, 84.80%; protein, 11.45%; fat, 2%; carbohydrates, .55%. 8% of the whole egg is shell, consisting largely of carbonate of lime.

COMPOSITION OF COMMON FEEDING STUFFS.

The table which follows gives the pounds of the different compounds in 100 pounds of each feed listed:

| <i>Feed</i> | <i>Water</i> | <i>Ash</i> | <i>Crude protein</i> | <i>Fiber</i> | <i>Carbohy- drates</i> | <i>Fat</i> |
|----------------------------------|--------------|------------|----------------------|--------------|----------------------------|------------|
| Corn and By-products | | | | | | |
| Dent corn | 10.6 | 1.5 | 10.3 | 2.2 | 70.4 | 5.0 |
| Sweet corn | 8.8 | 1.9 | 11.6 | 2.8 | 66.8 | 8.1 |
| Corn meal | 15.0 | 1.4 | 9.2 | 1.9 | 68.7 | 3.8 |
| Gluten meal | 8.2 | 0.9 | 29.3 | 3.3 | 46.5 | 11.8 |
| Hominy meal | 11.1 | 2.5 | 9.3 | 3.8 | 64.5 | 8.3 |
| Wheat and By-products | | | | | | |
| Whole wheat | 10.5 | 1.8 | 11.9 | 1.8 | 71.9 | 2.1 |
| Wheat screenings | 11.6 | 2.9 | 12.5 | 4.9 | 65.1 | 3.0 |
| Wheat bran | 11.9 | 5.8 | 15.4 | 9.0 | 53.9 | 4.0 |
| Wheat middlings | 12.1 | 3.3 | 15.6 | 4.6 | 60.4 | 4.0 |
| Wheat shorts | 11.8 | 4.6 | 14.9 | 7.4 | 56.8 | 4.5 |
| Stale bread | 31.2 | ... | 6.9 | ... | 44.2 | 0.5 |
| Oats and By-products | | | | | | |
| Oats | 10.4 | 3.2 | 11.4 | 10.8 | 59.4 | 4.8 |
| Oat meal | 7.9 | 2.0 | 14.7 | 0.9 | 67.4 | 7.1 |
| Ground oats | 7.7 | 3.7 | 16.0 | 6.1 | 59.4 | 7.1 |
| Rolled oats | 8.4 | 1.9 | 15.0 | ... | 66.6 | 7.5 |
| Barley and By-products | | | | | | |
| Barley | 10.9 | 2.4 | 12.4 | 2.7 | 69.8 | 1.8 |
| Malt sprouts | 10.2 | 5.7 | 23.2 | 10.7 | 48.5 | 1.7 |
| Dry brewers' grains | 8.2 | 3.6 | 19.9 | 11.0 | 51.7 | 5.6 |
| Buckwheat and By-products | | | | | | |
| Buckwheat | 12.6 | 2.0 | 10.0 | 8.7 | 64.5 | 2.2 |
| Buckwheat middlings | 13.2 | 4.8 | 28.9 | 4.1 | 41.9 | 7.1 |
| Rice and By-products | | | | | | |
| Rice | 12.4 | 0.4 | 7.4 | 0.2 | 79.2 | 0.4 |
| Rice bran | 9.7 | 10.0 | 12.1 | 9.5 | 49.9 | 8.8 |
| Peas and By-products | | | | | | |
| Peas | 13.4 | 2.4 | 22.4 | 6.4 | 52.6 | 3.0 |
| Field beans | 15.0 | 3.1 | 20.4 | 3.2 | 56.7 | 1.6 |
| Soy bean meal | 10.8 | 4.7 | 34.0 | 4.8 | 28.8 | 16.9 |
| Miscellaneous Grains | | | | | | |
| Kafir corn | 9.3 | 1.5 | 9.9 | 1.4 | 74.9 | 3.0 |
| Sunflower seed | 8.6 | 2.6 | 32.8 | 13.5 | 27.1 | 9.1 |

| <i>Feed</i> | <i>Water</i> | <i>Ash</i> | <i>Crude protein</i> | <i>Fiber</i> | <i>Carbohy- drates</i> | <i>Fat</i> |
|-----------------------------------|--------------|------------|--------------------------|--------------|----------------------------|------------|
| Flaxseed and By-products | | | | | | |
| Flaxseed | 9.2 | 4.3 | 22.6 | 7.1 | 23.2 | 33.7 |
| Linseed meal—N. P..... | 10.1 | 5.8 | 33.2 | 9.5 | 38.4 | 3.0 |
| Cotton seed feed..... | 8.2 | 7.2 | 42.3 | 5.6 | 23.6 | 13.1 |
| Meat and By-products | | | | | | |
| Green bones | 6.9 | 24.5 | 22.3 | ... | ... | 16.5 |
| Beef scrap | 1.3 | 8.0 | 58.0 | ... | ... | 32.9 |
| Pork scrap | 0.8 | 2.2 | 57.4 | ... | ... | 39.6 |
| Blood meal | 9.6 | 3.8 | 74.1 | 2.2 | 8.8 | 2.1 |
| Fish, etc. | | | | | | |
| Fresh fish | 44.0 | 1.0 | 10.5 | 42.0 | ... | 2.5 |
| Fish scrap | ... | ... | 34.0 | ... | ... | 6.5 |
| Shell fish (average) | 33.1 | 0.9 | 4.2 | 60.2 | 1.1 | 0.5 |
| Milk and By-products, etc. | | | | | | |
| Whole milk | 87.2 | 0.7 | 3.6 | ... | 4.9 | 3.7 |
| Skim milk (separated)... | 90.6 | 0.7 | 3.1 | ... | 5.3 | 0.3 |
| Buttermilk | 90.1 | 0.7 | 4.0 | ... | 4.0 | 1.1 |
| Cheese | 34.4 | 3.4 | 23.7 | ... | 1.7 | 36.9 |
| Whey | 93.8 | 0.4 | 0.6 | ... | 5.1 | 0.1 |
| Eggs. | | | | | | |
| Hen eggs | 65.5 | 0.9 | 11.9 | 11.2 | ... | 9.3 |
| Grasses, etc. | | | | | | |
| Lawn clippings | 76.4 | 2.4 | 2.3 | 4.1 | 13.8 | 1.0 |
| Red clover (cut) | 70.8 | 2.1 | 4.4 | 8.1 | 13.5 | 1.1 |
| Alfalfa (cut) | 80.0 | 1.7 | 4.9 | 4.7 | 7.9 | 0.7 |
| Barley (cut) | 79.0 | 8.8 | 2.7 | 7.9 | 8.0 | 0.6 |
| Miscellaneous Green Feeds | | | | | | |
| Cabbage (cut) | 90.5 | 1.4 | 2.4 | 1.5 | 3.9 | 0.4 |
| Lettuce | 95.9 | 0.8 | 1.0 | 0.5 | 1.6 | 0.2 |
| Spinach | 92.4 | 1.9 | 2.1 | 0.7 | 2.4 | 0.5 |
| Onion tops | 91.0 | 0.1 | 0.8 | ... | 3.0 | 0.2 |
| Roots and By-products | | | | | | |
| Potatoes | 78.9 | 1.0 | 2.1 | 0.6 | 17.3 | 0.1 |
| Mangels | 90.9 | 1.1 | 1.4 | 0.9 | 5.5 | 0.2 |
| Turnips | 90.5 | 0.8 | 1.1 | 1.2 | 6.2 | 0.2 |
| Rutabaga | 88.6 | 1.2 | 1.2 | 1.3 | 7.5 | 0.2 |
| Carrots | 88.6 | 1.0 | 1.1 | 1.3 | 7.6 | 0.4 |
| Parsnips | 88.3 | 0.7 | 1.6 | 1.0 | 10.2 | 0.2 |
| Onions | 87.6 | 1.0 | 2.6 | 0.8 | 15.9 | 0.2 |
| Fruits, etc. | | | | | | |
| Apples | 80.8 | 0.4 | 0.7 | 1.2 | 16.6 | 0.4 |
| Pumpkins | 90.9 | 0.5 | 1.3 | 1.7 | 5.2 | 0.4 |
| Pears | 80.9 | 0.5 | 1.0 | 1.5 | 15.7 | 0.5 |
| Plums | 78.4 | ... | ... | ... | 20.1 | ... |

Use of Composition Table. The above table will be useful in giving a general idea of the adaptability of the different feeds. Feeding stuffs containing 15% or more of crude protein are considered protein rich feeds. The digestible part of the fibre, carbohydrates and fats are used primarily for the production of heat and energy in the body. When a feed contains over 65% of carbohydrates, together with upwards of 3% of fat, it is considered rich in fattening qualities. The digestive system of poultry is not well suited to the digestion of crude fibre and it is probable that feeds containing over 5% of fibre are digested with difficulty by poultry.

No Digestion Tables for Poultry. Digestion trials have been carried on in this country and in Europe to determine the digestibility of different feed stuffs when fed to the larger animals, making possible the compilation of tables showing the relative amounts of digestible material in these feeds. A limited number of digestion trials have been conducted with poultry. These trials indicate that poultry do not digest feed stuffs in the same ratio as the larger animals and for this reason tables showing the digestibility of feeds when fed to larger animals (the only ones available), are not of service to the poultryman, and for this reason are not given here. The following quotations give the opinion of leading American poultry experts on this subject:

"It is probable that the accepted laws of nutrition observed with other animals hold true to only a limited extent in regard to poultry, but they form the best guide until more accurate data can be obtained. Birds have a type of digestive system entirely different from that of any other group of animals, are of a much more active disposition, and of a much higher body temperature, so that it is only reasonable to suppose that the same coefficients of digestion and the same energy values would not in all cases apply."

"Digestion experiments have been carried on with poultry at the Maine Station with certain definite results. Corn showed a higher digestibility than any other grain tested. Wheat bran, when fed to adult birds, showed a rather low digestibility. A mixture of finely cut clover and corn meal was a more economical feed than bran. It was found that any great proportion of crude fibre was undesirable, being but slightly digested and of little value other than giving bulk to the ration; and that the addition of about seven per cent. of bone ash slightly increased the digestion coefficient of a mixture containing vegetable matter."

"Considerable experimental work has been done by the United States Department of Agriculture pertaining to the digestibility of poultry rations. The results of the work show that corn in the ration is one of the most economical sources of crude protein, nitrogen-free extract (carbohydrates) and fat, because corn is highly digestible. Oats and wheat should be utilized for their crude protein and fat. Where wheat is used extensively, adequate provision must be made for the deficiency of fat in this grain. It was found that protein and fat in beef show high coefficients of digestibility, the protein considerably

higher and the fat but slightly lower than the corresponding nutrients in corn."

"Until recently, all feeding determinations have been based on standards of coefficients of digestibility derived from German sources. When these standards are used, the total nutrients in the ration are considered, and the requirements of the individual animal determine the exact feed stuffs and the proportion in which they should be combined. It must be remembered that no standard, however derived, can be properly used as the basis of absolute inflexible rules. They can be used as the starting point for the feeder, more especially the beginner, and are not supposed to eliminate the use of judgment."—*Productive Poultry Husbandry*, by Harry R. Lewis.

"Nutrients vary in digestibility. Creatures differ in digestive power, and the same creature digests a certain kind of food more completely at one time than at another. Investigators of the science of feeding have determined, by careful experiment, 'digestion coefficients' for most of the common food articles for the larger animals, and in a few instances for poultry; but, in the case of poultry especially, the observations are too few and the results too irregular to warrant the use of these coefficients in a study of foods and feeding."—*Principles and Practice of Poultry Culture*, by John H. Robinson.

Digestibility of Feeds. All feeds are divided into two parts, digestible and indigestible (milk excepted, which is all digestible). The digestible part, through the processes of digestion and assimilation, is taken up by the blood and distributed to all parts of the body, while the indigestible part passes off through the alimentary canal of the bird and forms the excreta, or droppings. It should be borne in mind that the digestible part of a feed only becomes assimilated in the manner stated, which fact determines the nutritive value of a food. Other things being equal, those feeds that are most easily digested ought to be given the preference, when selecting feeds. Palatability is another important factor in fixing the nutritive value of a feed. Grains covered with a husk are not as palatable as are those without a husk. The composition of the fowl's body plus that of the product bears a direct ratio to the digestible food required.

Use of Feeds. It is important that the feeder of fowls have a clear understanding regarding the uses made by the birds of the feeds by them eaten.

First, the demands of the body are supplied by what is known as the food of support.

Second, with the body needs provided for, any surplus food supply is used in the production of eggs or meat.

Nutrition. The life of the fowl is dependent upon nutrition, the natural processes through which feeds are utilized in and through the circulatory system in restoring and building up body tissue, maintaining body temperature, and providing for the body products. Life begins with the development of the germ in the fertile egg and at a tempera-

ture of about 103 degrees Fahrenheit. The fertile egg being subjected to the uniform temperature of 103° Fahrenheit growth begins, the germ receives its food supply from the white of the egg and thus the chick becomes developed. During the 48 hours just previous to becoming hatched the yolk becomes absorbed into the body of the chick, the chick in the meantime rapidly gaining strength. The chick requires no further nourishment until the third day after it was hatched. The white or protein part of the egg has furnished the material for the body and vital organs, and the yolk that for the required heat and energy that goes to maintain life in the body. Thus the contents of the egg are the sole source of supply to the life blood of the chick with all nourishment which, by and through the action of the heart, is carried to every part of the chick's body. The body temperature of the chick is about 105 degrees, which body temperature must be maintained or death follows; such temperature is dependent upon correct feeding and housing.

Nutrients. The digestible food materials that maintain and nourish the body and make the egg are termed nutrients. These nutrients are used as follows:

Protein. The digestible protein parts are largely utilized in making muscle, brains and nerves, also a large part of the skin, feathers and the egg. Without digestible protein in its ration the fowl would soon die. However, an excessive use of protein is not desirable. There are many varieties of protein, some of which are of vegetable origin and some are of animal origin. The protein found in wheat is of a different variety from that found in oats. That found in kale is of another variety from that found in mangels. Protein of animal origin appears to be more palatable to fowls than that found in the grains and vegetables. Experience teaches that the best feeding results always follow the feeding of a variety of proteins. It ought also to be remembered that mineral salts (ash) add greatly to the feeding value of protein. In other words, those feeds that are low in ash content and high in protein content are not as desirable as are the feeds that are high in both ash and protein. To illustrate, wheat is generally recognized as possessing a very high feeding value for poultry of all ages, while rice has a low feed value for poultry. The ratio that the digestible ash and protein bear to each other in wheat and rice is as follows, viz.: wheat, one pound of ash to six pounds of protein; rice, one pound of ash to twenty-two pounds of protein. It is noticeable in practice that the relative egg producing value of the various grains and their by-products increase as the ratio of the digestible ash and protein decreases or narrows. The white of the egg is almost pure protein.

Carbohydrates. These nutrients include the digestible starches, sugars and fibres and are chiefly valuable for producing body heat and energy.

Fat. The oil elements of feeds are termed "fats." These oils when oxidized in the fowl's system possess two and one-fourth greater

heating power than carbohydrates. Any surplus of these oils becomes stored up as fat on the fowl's body. The nutrients that make the yolk of the egg are largely drawn from this surplus fat.

Ash. The bony structure of the fowl's body and the shell of the egg consist chiefly of mineral compounds or ash. The lime phosphates may be considered the most important of the several mineral elements that should enter into the fowl's ration. To insure sufficient mineral elements the growing chick needs grit, bone, bran or alfalfa, and green stuff added to its ration, to which, with the laying hen, should be added crushed shells.

Dry Matter. Subtract the water content from the total composition of a feed and we have left what is termed the total dry matter of the feed.

Water. As before stated, more than one-half of the weight of the fowl's body is water. The fowl will live three times as long without food that is minus the water content as without water. The importance of a constant supply of pure water is obvious; water is the fowl's first and last need daily. Water aids greatly in maintaining a constant body temperature.

STANDARD GRAIN FEEDS.

The grains are the natural food of fowls and should form the basis of all rations. By reference to the tables in this bulletin it will be observed that each grain has its own peculiar composition and feeding value. Wheat is the most popular grain for poultry throughout the northwest. Ranking next in importance comes oats, barley, corn and peas in the order named.

Wheat. Wheat is low in fat and better results are secured by feeding wheat in combination with corn, oats or barley, which are high in fat. There is considerable difference in the quality and feeding value of wheats. The hard wheat is to be preferred to the soft wheat both for growth and egg production, there being a difference of from 30% to 50% in the gluten content in favor of the hard wheat. In soft wheat the interior of the kernel will be soft and floury, while in hard wheat the fracture, when cutting in half, will be short and brittle.

The mineral content (ash) of wheat is below 2%, while the body of the fowl is about 4% ash, and the egg, not including the shell, contains 3.4% ash. The clovers and vegetables are comparatively high in mineral matter and therefore should be liberally supplied to poultry at all times when feeding the grains, all of which are comparatively low in ash.

Barley. Barley is generally discriminated against as a food for poultry. This fact is due to its lower protein content than wheat, and the high percentage of fiber, which is of little food value for poultry. The hullless variety, however, may be economically used as a part of the grain combination for winter feeding and ground into a fine meal, for fattening fowls.

Oats. Oats is one of the best grains for egg production and cannot be too highly recommended. A heavy milling oat with a thin husk is to be preferred to the small lighter varieties that have too high percentage of fiber or husk. When oats are fed to the laying hen in combination with wheat in summer and wheat and corn in winter, equal parts of each grain by measure, excellent results follow. Like wheat, oats being low in ash require a good supply of clover or vegetables combined in the ration.

Finely ground oats can well constitute a part of all mashes, especially for growing stock and laying hens. Whole oats are sometimes rejected by fowls but they soon learn to like them, especially the plump and thin husked varieties.

Corn. Like the other grains mentioned, corn varies considerably in feeding quality, depending upon weather and soil conditions where grown. The hard and flinty varieties are the best for poultry. Practically all fowls are very fond of corn, and it can be profitably fed during cold and damp weather, preferably in combination with wheat or oats or both. The greatest value of corn as a poultry food lies in its heat producing qualities, due largely to its high "fat" content. Mouldy or smutty corn is unsafe to feed.

Peas are used as a poultry food only to a very limited extent, which is largely due to their apparently high cost, and general ignorance regarding their true feeding value. Peas are very high in protein, and therefore ought to be of great value as a part of the egg producing ration. Peas lack somewhat in palatability when fed alone. The best way to feed them is to grind them into a meal and make them a part of the mash mixture. The whole pea is better relished by fowls than when cracked or crushed and, while fowls may reject them for a time, they soon learn to like them and will eat them greedily. Peas can be successfully grown in most parts of the northwest. The vines make good hay. The smooth varieties are to be preferred to the wrinkled varieties for fowls.

Vetches. Vetches have a feeding value for poultry fully equal to that of peas. In mineral matter as well as in the protein content, vetches are superior to peas.

Flaxseed or Linseed. This is an important poultry feed that has not come into general use. A comparatively small percentage of flaxseed may be included in the hen's ration with much profit. Its use is largely confined to fanciers in the preparation of their exhibition stock for the shows. Flaxseed is much fed during the moulting period. A very little flaxseed jelly added to the mash gives good results, during cold spells of weather, and often prevents what is known as the partial moult. A little of the seed may be included in the young chick's ration. Flaxseed may be produced on many of the farms of our state.

Sunflower Seed. This feed has its place in the poultry dietary. Were it not for its high percentage of crude indigestible fiber, this seed would rank among the most valuable poultry feeds. A small

amount of sunflower seed may safely and profitably be included in the hen's ration at all times. Its greatest value as a poultry food is during the moulting period and in cold and damp weather, since its high oil content gives it exceptional heat producing power. Practically every farmer and poultryman of the state can grow his own sunflower seed. The sunflower is more apt to fully mature when grown on a well drained, sandy loam soil.

Buckwheat. This grain is variously estimated for feeding poultry. It is not a popular poultry feed in this state. While its chemical analysis shows it to possess feeding value, it appears not to be palatable and is not to be recommended for poultry where the other grains mentioned can be grown.

Mixed Feeds. A careful examination of ready-mixed poultry feeds to be found in the markets often shows them to contain foreign substances that are valueless for food purposes. Without doubt the better practice is to buy the whole grains and the mill feeds and do one's own mixing.

GROUND GRAIN AND MILL FEEDS.

The best results are secured when a mixture of meals are fed dry in a hopper in connection with the grains that are fed in the litter. Feeding trials have shown that 20 per cent. better results may be expected when a part of the ration is in the form of meal, fed as stated, as against the entire ration consisting of whole grains.

Wheat Bran and Shorts. As the names imply, these feeds are a by-product of wheat and, owing to their high protein and mineral content, rank as the most valuable of all the mill feeds for fowls of all ages and stages of development. Coarse, flakey bran is best for poultry when being fed for egg production or growth. Fine bran (shorts) contains more flour and can best be used in mash, used for fattening purposes, rather than for egg production. Coarse bran mixed with corn meal forms a basis for a variety of dry and wet mash mixtures for poultry.

Wheat Middlings. This feed is also a by-product of wheat, consists of the inner layers of the wheat, and some of the flour and, being practically minus the outer layer of the grain, is more digestible than bran and is often included in the dry mash mixture for egg production and the gruels that are used for fattening fowls.

Oatmeal or Ground Oats. These feeds can well constitute a part of rations for poultry, both young and old. Oats being low in mineral content, they should be supplemented by a liberal supply of green stuff, bran, etc.

Oats do well as a farm crop in nearly every part of the state and our farmers ought to grow the combination crop of oats and wheat for their poultry, when soil conditions are favorable. Hard, plump grains seldom result from seedings on low, moist, poorly drained soil. Seeding under such conditions generally results in a rank straw growth and small inferior grain.

Corn Meal. Corn meal, owing to its heat producing qualities, possesses exceptional value as a poultry food. Corn feed in its various forms is perhaps the most practical agency for maintaining the normal body temperature of fowls during extremely cold or wet weather. Owing to their high fat content these feeds ought to be fed very sparingly during the summer and mild weather periods. These feeds ought to be scrutinized very carefully since there is a great temptation among manufacturers to grind up damaged and mouldy corn, which makes an unsafe feed for poultry.

Gluten Meal. This is a by-product of corn and valuable for its high protein content. It is not greatly relished by poultry, but can be included in the mash mixtures and thus be made palatable.

Gluten Feed. This is a prepared food with gluten meal for its base. Its feeding value varies, depending upon the quality of corn bran with which it is combined.

Hominy Meal. This by-product of corn is sometimes used as a substitute for corn meal, possessing, as it does, about the same feeding value.

Sundries. Owing to the constantly growing list of manufactured products that are being extensively advertised for poultry feeding, it is not deemed advisable to continue these descriptions further. In the absence of a guaranteed analysis, these new feeds must necessarily be experimented with before their true feeding value may be known. Good sound food of known composition should be the watchword of every poultryman. Feeds of poor quality and of low digestibility cannot bring good results, either for growth, eggs or meat production.

ANIMAL FEEDS.

The value of poultry feeds is very greatly based upon their digestible protein content. Fowls are very partial to those feeds that contain animal protein, preferring some to the grains and vegetables that are also high in protein. Meat and milk are very high in digestible protein and in some form ought to constitute a part of the fowl's ration. While meat may be fed to poultry fresh, or preserved, prepared and fed in like manner as for human consumption, it is commonly fed in the form known as meat scrap. Meat ought to be thoroughly sterilized before being fed to poultry. The approved brands found on the market are sterilized. The pullet's or laying hen's ration may contain as high as from five to twelve per cent. of meat scraps, depending upon the remaining nutrients of the ration. Meat may be fed mixed into the dry mash or it may be fed in a separate hopper, when the fowls have for a time been regularly receiving meat in their daily ration. When milk is being fed the fowls will not require so much meat. Milk, either sweet or sour ought to be fed regularly, otherwise it had best be fed cooked into a curd. Sour milk is one of the best poultry feeds for growth as well as for egg and meat production.

Beef or Meat Scraps. These feeds, when of good quality, are without doubt entitled to first place on the list of animal feeds. These

scraps vary considerably in quality containing as high as 60 per cent. protein and as low at 35 per cent. The high grade scraps are safer and in every way much to be preferred. Pork scraps are less digestible, and therefore, possess a lower feeding value than do beef scraps.

Corned Meats. The meat of healthy animals freshly corned in the usual way, when thoroughly freshened by soaking in two or three waters and then boiled, is an inexpensive and practical way for the farmer to utilize the animals unfit for merchantable meat, for a good supply of animal feed for the fowls. Poultry of any kind should never be allowed to eat stale or putrid meat of any kind, as all such feeds are unhealthy. Uncooked meats are often unsafe to feed poultry.

Bones. Bones in both the dry granulated and the cut green state are greatly relished by fowls, and are chiefly valuable for the ash or mineral matter they contain. Bone meal can be fed sparingly in the young growing chick's ration, while green cut bone should be fed with caution both regarding the quantity as well as their quality. Two or three feeds a week will do.

Animal Meal. This is quite a common feed found in the market, and generally consists of the lower grade of meat scraps ground up with bone and fat, thus making a feed of more or less doubtful quality, and that ought to be sold under a guaranteed analysis, otherwise the safer practice for the poultryman would be to buy the high grade beef scrap and the bone separately.

Dried Blood or Blood Meal. This is another common form of animal feed and possesses high keeping qualities and may be sparingly used in nearly all mash mixtures. It possesses properties that give it value in preventing diarrhoea in fowls.

Fish, Clams and Oysters. These feeds are greatly relished by poultry but, owing to their tendency to taint both the eggs and meat, poultry should be fed them in but very limited quantity, if at all.

Fish Scraps or Meal. This feed has recently been introduced in the markets of the Pacific coast as a poultry food and, while it cannot be considered as a full substitute for meat scrap, there can be no good reason why it should cost the poultryman to exceed one-half of what meat scraps can be supplied for. These feeds, while lower in protein, are considerably higher in ash or mineral content. The process of their manufacture appears to remove their tendency to taint the eggs and meat.

Eggs. Eggs that have been rejected from the incubator during the first week of incubation may be boiled hard and then chopped fine and, when mixed with bran, can well be fed to young chicks after two weeks of age. The fresh raw egg mixed with toasted bread crumbs, bran or oatmeal to a crumbly mash, forms a very nutritious food for the baby chicks.

MILK BY-PRODUCTS.

Skim Milk. Skim milk furnishes an excellent source of animal protein. Although it is not a complete substitute for high grade meat

scraps, fowls of all ages are very fond of skim milk. This feed not only promotes growth, but eggs as well. Skim milk can be safely fed either fresh, sour, clabbered, or made into a curd by cooking. Milk may be fed either sweet or sour, preferably slightly acid after the chicks are two weeks old. For moistening fattening mixtures sour milk is indispensable for best results. With high grade meat scraps costing \$4.00 per 100 pounds skim milk is worth more than 25 cents per 100 pounds for feeding poultry.

Buttermilk. This dairy by-product possesses a somewhat higher feeding value for poultry than does skim milk. However, it does not have as uniform quality as does separator skim milk.

Whey. Whey is greatly relished by poultry but does not have the feeding value of skim milk or buttermilk.

Evaporated Milk. This is a desirable food when the price is not prohibitive.

Milk Albumen. This feed, which is obtainable in the markets, is a very concentrated form of the casein content of milk, which contains the protein nutrients, and it is practically equal in value to a good grade of meat scraps as a poultry food.

SUCCULENT AND GREEN FEEDS.

Alfalfa, the clovers and grasses, cabbage, lettuce, kale, mangels, carrots and the like are all valuable as a poultry food for their succulent and mineral content as also for their palatability. One or more of these feeds are indispensable to a complete and well balanced ration for poultry. Alfalfa and clover hay and grasses may be cut short and fed in the dry or wet mash mixtures and also may be scalded and fed as a substitute for green succulence. Cabbage, lettuce and kale can be suspended by a wire about one foot above the floor of the scratch room, while mangels and other roots may be driven over a large nail or spike against the wall. These feeds must be kept clean and sanitary. By growing a variety of these crops a continuous supply of these feeds can be provided easily and cheaply.

Raw Potatoes and Apples. These feeds are only entitled to a very low place in the list of succulent feeds when their palatability and relative feeding value is considered. At best, potatoes and apples should be fed sparingly. The practice of cooking the potatoes and mixing them with bran is to be recommended when fed at all. Apples fed liberally have the effect of decreasing the hen's appetite for a complete ration, resulting in a greatly diminished egg yield. These feeds also have a tendency to burden the fowls with an excess of fat.

Onions. An occasional feed of onions chopped fine and mixed with the moistened mash has a desirable tonic effect and are relished by the fowls.

Sprouted Grains. Sprouted grains are an excellent substitute for green stuff when carefully fed, oats being generally used for this pur-

pose. The oats should be plump and bright and may be sprouted as follows: Fill a common bucket one-half full of oats, then pour over the oats two-thirds as much warm water (90° to 100°) as there is oats. To prevent mold add one drop of formalin for each quart of the contents of the vessel. Allow the oats to soak forty-eight hours, when they will have taken up all the water. The oats can now be poured out in a flat box or boxes to a depth of one inch. Keep the box in a room with a temperature of 60° to 75° F. and sprinkle the oats well with lukewarm water twice daily. The oats will be ready to feed in about one week, and should be fed out within about four days, when their feeding value begins to deteriorate. Feed in a flat bottomed trough or box as much as the fowls will clean up quickly. The rule is, about one square inch of the feeding surface of the sprouted oats daily per mature fowl. This feed is greatly relished by all fowls. By having the sprouting boxes of uniform dimensions the same may be placed one above the other, 6 or 8 inches apart, in a rack so as to be drawn out one at a time, thus economizing space and adding to the convenience in doing the work. Another method is to use the oats in the scratch combination when the sprouts in the same are about one inch in length.

MINERAL MATTER.

When the fowls are fed a variety of grain, grasses, grits and animal feeds no further attention need ordinarily be given to the supply of mineral matter in the ration, as such a combination can be relied upon to contain all that is required of these elements. Bran is a very valuable feed for the young growing chick because of its mineral content. Often soft shelled eggs indicate a deficiency of mineral matter in the laying hen's ration.

More recent investigations conclusively show that too little regard has been and is being given to the mineral content of the hen's ration. Mineral compounds increase the digestibility of the protein content of the ration as well as enter into the composition of the fowl's body, and thus serve a two-fold purpose, in the fowl's ration. With the exception of wheat bran, soy bean meal, and linseed meal most of the grains and mill feeds are considerably deficient in ash or mineral matter, for poultry requirements. Other palatable feeds high in mineral matter ought to be supplied, like the green feeds mentioned.

Dry Granulated Bone. This is high in protein and mineral matter (phosphate) and is greatly relished by poultry of all ages. This bone may be kept before the fowls in a hopper.

Fresh Cut Bone. Fresh cut bone is a popular form of bone for supplying protein and mineral matter in the laying hen's ration. This bone should be fed sparingly. Young chicks should get bone in its fine, dry, granular form.

Crushed Shells. Shells are generally recognized as being the cheapest and best source of lime in the laying hen's ration, furnishing the mineral matter from which the egg shells are very largely formed.

OTHER FEED SUPPLIES.

Sharp Grit. Perfect digestion requires sharp grit in the fowl's ration. The sharper the grit the better, excepting glass, which will not do. Fowls not having teeth, the grit serves the purpose of grinding the food and therefore should be of good quality. Grit ought to be kept before the fowls at all times. Sharp sand, broken crockery, sharp quartz in $\frac{1}{4}$ -inch cubes is what they need. Granular bone is a partial substitute for grit.

Charcoal. Charcoal in some form should be included in the hen's ration. Granular wood charcoal is the most desirable form, while a charred stick of wood will do.

Condimentals. Condimentals ought very rarely if ever be used. They are too stimulating and their effects are not lasting. Their food value is very low.

Water. Fresh water is a necessity and required to be before the fowls at all times. 100 hens will require from 6 to 16 quarts of water daily, depending upon the number of eggs they are producing and the season of the year. Heavy laying and warm weather conditions demand more water.

FEEDER'S PROBLEMS.

The feeder ought to feed to a purpose, and formulate the fowl's ration accordingly. That is to say, the object should be either growth and development, body support without growth, egg production, fattening for the market or exhibition qualities.

Laying Condition. The laying hen must be a healthy and contented hen. The hen naturally seeks her food. She is industrious, picking up here a seed and there a seed, a worm, an insect, a grit and a shell with a frequent bite of grass and a drink of water. The egg producing birds, the developing pullets, and the stock males should all be required to exercise for a considerable part of their ration. Exercise promotes health and vigor. Accordingly the grains ought to be scattered in dry litter, six to eight inches deep, or in coarse sand or gravel that the fowls may search to find their food.

Selecting the Layers. The practice of casting out chicks by reason of deformity or lack of vigor should be adopted from the start when the chicks are first put into the hover. A most rigid culling should be practiced at the time of selecting the pullets for the laying pens. This selection ought to be made about one month before laying age and again at laying age. The selected flock should be confined to those birds that meet, reasonably well, the standard requirements as to type, health and vigor. Nearly all prolific layers meet these requirements. Pullets become fully grown at from 6 to 8 months of age, depending upon the breed. Birds belonging to the Mediterranean class, like the Leghorns, should begin laying at about five months of age, but do not become fully grown until about a month later. Birds of the American and other classes should begin laying at six and one-half to

seven and one-half months of age. For fall and winter layers the pullets ought to reach maturity by November first.

Small vs. Large Flocks. For the maximum average egg production per hen and at the lowest feed cost flocks of not to exceed twenty birds are to be recommended. For producing eggs at the lowest labor cost per dozen 500 birds may be housed and fed together. All things considered, flocks of 200 to 300 hens will produce eggs the most economically.

The Laying House. Between September 1st and 15th, the pullets should be put into their permanent fall and winter quarters, or about one month before they should begin laying. They require a little time to become reconciled to the change from the range to their new home. Laying hens generally resent being transferred into new quarters and quit laying for a time. Spring-like conditions should prevail. Ample provisions should be made for the sunshine, good air and exercise. The house must be kept dry, clean and sanitary.

Managing the Layers. Do not keep a male bird with the laying flock. The place for the male is in the breeding pen and only during the breeding season. At other times the males should be kept in a pen by themselves. This system insures more eggs and eggs which keep better. The birds enjoy the sunshine during the winter, and shade during hot summer days. They need pure air and both a dry and a moist place in which to scratch. The roosting room should be cleaned not less than twice a week, all of which is conducive to health and vigor in the flock and more eggs.

FEEDING FOR EGG PRODUCTION.

A Variety Important. Poultry naturally thrives best when given a variety of feeds. No less than three of the different grains should comprise the scratch food, and as many kinds of the grain by-products ought to be included in the dry mash mixture. Any changes in the feeds or in the system of feeding ought to be made gradually.

Laying Rations. By "ration" is meant the daily allowance of feed given a fowl or the flock.

The "balanced ration" is defined by Henry's Feeds and Feeding as "A combination of farm foods containing the various nutrients in such proportion and amount as will nurture the animal for 24 hours, with the least waste of nutrients."

When applied to the laying hen the ration may be said to be "balanced" when a variety of feeds have been so accurately compounded as will fully nourish the body, make the egg and supply the necessary bulk without any waste of nutrients.

The laying hen requires a ration in which the protein, carbohydrates and fat bear to each other the relation approximately of 1 to 4.5, that is to say, to one pound of protein there should be four and a half pounds of carbohydrates and fat.

Birds Balance Ration. The fowls will instinctively balance their own ration more accurately than it can be otherwise done. To do this it is necessary that the feeder make available to the flock a variety of feeds. There ought not to be less than three kinds of grain in the scratch feed and three kinds of by-products of the grains in the dry mash mixture. Also green stuff, grit, shells, bone and charcoal should be provided. There is no one grain that will do alone for the reason that all of the nutrients required to make the energy, flesh and the egg are not contained in a single variety of feed in the right proportion, hence economic considerations demand a variety of feeds.

A Model Ration. There are many good rations that may be easily compounded from the variety of feeds that are listed in the feed table given herein. Some are simple and some are complicated. Both kinds when properly fed will bring good results. The following simple ration and system may be safely adopted for winter feeding a flock of hens.

1. Early in the morning 5 to 6 pounds of scratch food, consisting of equal parts by measure of sound wheat, corn and oats to be buried in dry litter 6 to 8 inches deep.

2. Sour milk, also pure water, in separate vessel.

3. Green feed such as kale, cabbage, green grass and the like.

4. A dry mash consisting of a mixture of equal parts by weight of coarse bran, ground oats, corn meal and wheat middlings, and ten per cent. of beef scrap, fed in a hopper to which the fowls have access afternoons only.

5. An evening feed of 8 to 10 pounds of the mixture of scratch feed early in the evening.

6. Grit, granulated bone, crushed shells and charcoal fed in a hopper available at all times.

7. A feed of fresh green cut bone twice a week will prove advantageous. It is greatly relished by the birds and adds to the variety. Cooked lean meat when available, may be substituted for the beef scrap. Birds on the good range, of course, will gather the necessary green feed. During the moult add 20 per cent. of oil meal to the dry mash or feed sunflower seed, preferable in the head, unthreshed. These feeds will materially aid in the growth of the new plumage. Sprouted oats may be substituted for the whole oats.

Summer Ration. The same ration as the model ration is suited for summer, except that equal parts by weight of wheat and oats should be substituted for three-fourths of the corn.

FEEDING BREEDING STOCK.

Generally, too little care and attention is given the food and feeding of the breeding flock. This is a point where mistakes are far reaching in their effects upon the future generations. The hen being a machine, a function of which is to convert grain and other feeds into eggs, possesses the power of exercising such function largely in proportion as she has been correctly fed and nourished. Good health being the cornerstone upon which producing power must rest, and also being de-

pendent upon pure and wholesome food, good air and sunshine for its development, it is at once apparent that a well balanced ration of suitable feeds must be provided the breeding stock. Should any one doubt the proposition a demonstration would be interesting. Take two pens of breeders and feed and care for one pen correctly and the other pen indifferently, and note the results with the progeny, and all doubts will be removed. For the breeding stock there must be provided a sanitary coop, wholesome feed and exercise. A moistened mash ought not to be fed oftener than once a week, and then only for variety. Equal parts of bran and oatmeal scalded with a meat soup cannot be surpassed. Equal parts of bright plump oats and wheat, with one-third peas and barley or peas and corn added and all well mixed makes an excellent scratching combination. Keep in hoppers before the fowls at all times coarse grit, shells, bone and charcoal. Also feed green stuff and a dry mash of bran with five to ten per cent. of beef scraps added to be fed in a hopper to which give the fowls access for two hours near the middle of the day. Clear fresh water must be kept before them, and sour milk if available. A good dust bath is indispensable.

We would caution against over feeding. The litter needs to be frequently examined to see that the birds clean up every day, and to take notice of the feeds that they appear to crave most. A fresh supply of litter ought to be provided frequently, say as often as ten days or two weeks.

MISCELLANEOUS.

The Broody Hen. The hen showing symptoms of wanting to set, when not required for that purpose should be "broken up" at once. Remove the hen from the nest and into a suspended cage with a slatted bottom without any nesting material. Confine the feed to wheat, green stuff, shells and water or sour milk. Have one side of the cage slatted so the bird can feed from the outside. In two or three days she can be given her liberty and she should begin laying again in about one week.

Wet Mash. A moistened mash may be safely fed once or twice a week. The dry mash mixture may be used, and moistened with sour milk, or meat soup. This adds to the variety and is greatly relished by the birds.

Cockerels. The young cockerels ought to be kept by themselves as soon as they can be distinguished from the pullets. The pullets will develop better. Those cockerels not to be needed for breeding purposes may be at once fattened as explained herein.

A FATTENING FEED FOR COCKERELS AND CULLS.

The cockerels that are not to be kept for breeding purposes, and the culls of the flock, ought not to be kept longer than necessary to condition them for the market. Every day beyond this period these birds continue to be a fruitful source of annoyance and expense. Under proper management such birds can be readily and cheaply fattened and

made marketable. Since from fifty to seventy per cent. of all the chicks hatched are cockerels and culls this fattening process becomes a very important part of the feeder's work. Mistakes at this point are responsible for more failures in the poultry business than any other factor except the person in charge.

The following plan when followed invariably brings satisfactory results and is suited to such poultrymen as are working on a small scale. Provide a crate, 24 inches by 15 inches and 18 inches high with a hopper at one end and a trough along the outside. Use a removable bottom or same made of wire screen of one-half inch mesh. Arrange a pan or droppings board a few inches from and directly under the crate, so that it may be easily removed and cleaned as occasion requires. Such a crate would answer for four to six birds at a time. Place the crate where the birds will not be disturbed.

The ration should consist of equal parts of ground oats, middlings and corn meal, with twenty per cent. beef scraps moistened with sour milk and fed in quantities that will be eaten clean three times daily. (The corn meal can well be cooked by pouring boiling water over it and then adding to the mixture.) Always remove the trough when the birds have become fully fed. Let the first feed be early in the morning and the last one late in the evening. The sour milk is all important. Twenty-five per cent. of proteina (soy bean meal) may be safely added if desired in place of the beef scrap. Keep the hopper supplied with coarse grit and charcoal. Give the birds milk to drink twice daily. It will require from ten to twenty days to fatten the birds. Average cost per pound gain under this system should not exceed six cents.

FEEDING THE CHICKS.

The prime object in chick feeding is to secure the healthy normal growth and development of the chick. The following are a few points that are vital to success:

1. The first feed ought not to be fed too soon and thus impair the chick's digestion. The first feed should be given when the chicks are 48 hours old.

2. Grit, shell and bone should be constantly before the chicks, which ensures a healthy digestion and the lime essential to a proper bone development.

3. Pure fresh water and sour milk should be liberally supplied. One-half of the chick's body is water, and normal growth cannot proceed without an ample supply of water. Stale water is dangerous to the chick's life, since it carries disease germs, and ought not to be used. The acid of sour milk is a recognized preventative of white diarrhoea and may well be fed from the start.

4. Wet mashes are conducive to a greater mortality than are dry feeds, therefore cracked grains and dry mashes are to be recommended.

5. Mineral matter (ash) is essential to the growth of both the flesh and bone of the chick, and for the best results should come from both mineral and animal sources. Shell and grit represent the mineral and beef scrap and bone the animal sources.

6. Exercise is conducive to the chick's health; scratching is natural, therefore cover a part of its feed with chaff that the chick may scratch to find it.

7. Succulent feed when fed in connection with the dry grain and mash has a medicinal effect and is conducive to the health of the chick. Lawn clippings, lettuce, cabbage, etc., are representative feeds of this character.

8. Cleanliness must be observed in every detail of chick feeding, thus avoiding many diseases.

9. Over feeding is to be avoided. Chicks should be fed only a little at a time but often, also early in the morning and late in the evening and thus shorten the period between the evening and the next morning meal.

A FEW COMMON CAUSES OF LOSSES.

Under a proper system of artificial brooding the losses by death should rarely exceed ten per cent. of the vigorous chicks. When such loss exceeds ten per cent. of the chicks, they can usually be traced to some of the following causes:

Chilling. Chilling from any cause usually is followed by digestive troubles and many losses. The temperature of the house ought to be constant and regular.

Crowding. Many chicks die from suffocation. There may be too many chicks in the brooder or the brooder may be poorly ventilated. The chicks lose vitality and finally die.

Over Heating. The over heating of the chicks has a similar effect to chilling and a loss of vitality.

Toe Picking. This disgusting practice often leads to cannibalism. It is an evidence of insufficient ash or mineral elements in the ration. The chicks attacked should be removed at once and the flock kept busy, and given access to the following mixture that may be fed in a dish that all can get to easily: Equal parts by weight of wheat, bran, meat scrap or fish scrap, dried bone and crushed oyster shells. This often ends the trouble.

METHOD OF CHICK FEEDING.

A good method of feeding the chicks until nine or ten weeks of age, and one that can be recommended through the northwest, is the following:

1st. Week. The absorbed yolk being nature's source of body nourishment just prior to and during the process of hatching and for two or three days thereafter, nothing except sharp, fine sand and sour milk need be given the chick, until the third day after hatching. Then for four days feed commercial chick feed, or steel cut oats and toasted bread crumbs should be fed. Feed five times a day in a saucer as much as the chicks will clean up in fifteen or twenty minutes. Sour milk (not decomposed), but no water, should be supplied the chicks.

2nd Week. The same feed should be fed as the first week only scatter the grains over litter and moistened earth or sand four times daily. Keep the brooder supplied with a fresh sod containing tender green grasses. Keep equal parts of coarse flakey bran and sifted beef scraps in a chick hopper before the chicks at all times. Sour milk or buttermilk should be supplied for drink, but no water.

3rd to 7th Week. A chick feed mixture can be prepared as follows: Two parts cracked wheat, two parts steel cut or hulled oats, and one part cracked corn or barley. Feed this mixture twice daily in litter from three to four inches deep (deepen the litter as the chicks get older). Mix the grains and litter well. Keep in a hopper and always available a dry mash consisting of equal parts by weight of wheat bran, ground oats, wheat middlings and beef scraps. Equal parts of sour milk and water should be supplied in separate vessels, also green stuff. Grit, crushed shells, granulated bone and charcoal should always be available in a hopper.

8th to 10th Week. Feed equal parts hard wheat, sprouted oats (sprouts one inch long), cracked peas and cracked corn in deep litter twice daily. A dry mash consisting of equal parts by weight of coarse bran, ground oats, corn meal and ten per cent. soy bean or linseed meal, should always be available in a hopper. Pure fresh water should always be available. Grit, crushed shells, green bone and charcoal in some form should always be available. Green stuff of some kind should be provided.

11th Week. Should the weather be favorable the chicks can now be put on the free range if possible and may be fed equal parts of whole wheat, plump oats and cracked corn in a hopper and one feed daily scattered over the range in the grass and among the weeds and trees. A dry mash consisting of equal parts by weight of coarse bran, wheat middlings and corn meal and ten per cent. of linseed meal or fifteen per cent. of soy bean meal added should always be available in a hopper. Fresh water and sour milk or beef scrap, grit shells and bone must always be provided.

Free Range. Free range means healthier and better birds and a saving of feed while the birds are developing.

Green Feed is indispensable to the bird's healthy growth. The free range often provides an ample supply of such feed in the grasses and clovers.

Shade and Shelter are necessary. Tall growing crops like corn, kale, sunflowers or trees make the best shade, while a cheap and portable coop will answer for shelter. Such a coop must be of ample size, at the rate of four square feet of floor for 100 mature birds, and must be well ventilated, crowding and vitiated air both check healthy growth and development. A portable coop occasionally transferred to a fresh spot on the range eliminates the danger of the ground becoming poisoned by the droppings and becoming unsanitary.

Dry Mash. We recommend the following dry mash mixture for the developing pullets on the range, which at all times should be kept before them in a suitable hopper:

| | |
|--------------------|----------|
| Ground oats | 100 lbs. |
| Wheat bran | 75 lbs. |
| Alfalfa meal | 25 lbs. |
| Corn meal | 50 lbs. |
| Meat scrap | 20 lbs. |
| Proteina | 20 lbs. |

A grain ration to be fed twice daily as a supplement to the dry mash can consist of 2 parts wheat and one part corn or hullless barley, which should be scattered broadcast over the range.

Feeding Young Turkeys or Poults. Aged hens are to be preferred in the breeding pens. Hatching can be done under hens or in incubators. Reasonably dry conditions are necessary to the successful rearing of the poults. Incubator hatched poults need to be taught to eat. A few lively chickens placed with them will soon have them taught.

Poults must be fed many times daily—a very little at a time. Stale bread moistened with milk is one of the best feeds the second, third and fourth days, with onion tops or garlic cut fine for green food. Afterwards they can be gradually changed onto one of the recommended chicken rations. The domestic turkey when intended for market had best be reared in some confinement, under such climatic conditions as exist throughout the northwest, west of the Cascade range, except in a few scattering areas of limited extent.

Wherever grasshoppers and like pests are plentiful, turkeys will do well with little else to eat than such as they pick up on the range and get from their hopper to be constantly supplied with equal parts of dry bran, and oat meal, with twenty per cent. beef scraps added.

A single comparative trial in raising turkeys in confinement until four months of age, and on the range, was made at the Western Washington Experiment Station with results greatly favoring the confinement system for all market stock. The flock that was raised in confinement—a roosting place attached to an open pen 4'x20'—was hatched in incubator on July 6th and the range flock on July 9th. Both flocks were carried over for the Christmas trade, therefore, were about five and one-half months of age when marketed. The flock raised in confinement when marketed weighed as follows: hens 13 to 15 pounds each, and toms 17 to 19 pounds each; while the range flock weighed: hens 8 and 9 pounds each and the toms 11 to 13 pounds. Both flocks had practically the same grain feed. A brief summary of this experiment is printed in U. S. Farmers' Bulletin 465.

Feeding Ducklings. Provide an inexpensive shelter with a dry floor, which must be kept clean and sanitary. Have plenty of clean, dry straw on the floor. Keep before them grit, gravel and sand and pure, fresh drinking water at all times, night and day.

A mash feed of uniform composition is very desirable, the concentrated part of which may consist of equal parts, by weight of bran, middlings, oat meal and corn meal with a little soy bean meal and ten per cent. of beef scraps or fresh meat added. One-half of the bulk of the mash should consist of scalded alfalfa or clover meal in the absence of lawn clippings or other cut green stuff. Water should always be at hand when ducklings are fed. As they grow the ducks should from time to time be separated into smaller flocks, each flock to comprise birds of uniform size. Market ducks had best be marketed at about eight weeks of age, since further feeding becomes less profitable.

The following duck feeding trial was carried on at the Western Washington Experiment Station with the results indicated. Forty-six ducklings were hatched July 14th, 1910. When hatched they weighed six pounds.

| Date 1910 | POUNDS OF FEED | | | | | Aver. cost of feed per pound | Total cost of feed | Weight duck- lings, lbs. | Cost per pound gain |
|-------------------|----------------|-------------------|-------------------|-----------------|------------------|---------------------------------------|-----------------------------|-----------------------------------|------------------------------|
| | Bran | Corn meal | Mid- dlings | Pro- teina | Total | | | | |
| July 26 | 4 | 2 | 3 | $\frac{1}{2}$ | 9 $\frac{1}{2}$ | \$.014 | \$.14 | 9 $\frac{1}{2}$ | \$.014 |
| July 29 | 13 | 4 | 4 | 1 $\frac{1}{2}$ | 22 $\frac{1}{2}$ | .014 | .82 | 17 | .019 |
| August 12 | 46 | 14 | 14 | 5 | 79 | .014 | 1.11 | 61 | .018 |
| August 26 | 187 | 37 | 46 | 12 | 233 | .014 | 3.25 | 116 | .028 |
| September 3 | 174 | 37 | 72 | 21 | 304 | | 4.26 | 154 | .027 |
| October 26 | 485 | 105 $\frac{1}{2}$ | 190 $\frac{1}{2}$ | 44 | 834 | | 11.67 | 196 | .059 |

NOTE: Seven of the ducklings died between September 11th and September 25th, weight 22 $\frac{1}{2}$ pounds. The mash was moistened with sour milk during the whole period.

The results show that Sept. 3rd, at the age of 8 $\frac{1}{2}$ weeks, the duckling's feed cost averaged .027 cents per pound gain. October 26th, nearly eight weeks later, their average feed cost had increased to .059 cents per pound gain, which goes to show that had the ducks been sold on Sept. 3rd more than double the profit would have been realized.

Feeding Goslings. Parents should be mated in December, one gander to three or four geese not less than one year of age.

Eggs can be incubated by large hens. Five eggs constitute a setting. The nest must be well moistened. The goose should be given a large, roomy and damp nest. Goose eggs are also hatched under turkey hens and in incubators. The young should be cooped and kept in a dry run for a week, when they should be given their liberty and a chance to graze. From this time on no hovering will be necessary, only good shelter, without artificial heat.

Feed the same as turkeys and ducks the first day. Then, while they are getting strong, feed a mash of scalded wheat, greens, vegetables, grass and potatoes sprinkled with a little barley meal. When the goslings are strong and running on good pasture little other feed will be required.

POULTRY DISEASES.

The writer's practically continuous experience with poultry covers a period of nearly fifty years. For some thirty years he has been a careful student of the many problems that pertain to poultry and successful poultry culture in the northwest. For economic reasons he has not "doctored" a sick hen for more than twenty years. His observation has been that the more one doctors his fowls the more he will need to doctor them.

The poultryman should study how to prevent, rather than waste time and money in trying to cure, disease. He ought to be able to pass upon the health of a bird at sight. This calls for a daily inspection of the flock. Upon the first evidence of something wrong the bird or birds ought to be isolated from the flock at once and removed to a hospital or some comfortable place for treatment. If the bird does not promptly respond to some simple treatment and be well again within a day or two it should be pronounced sick and all sick birds should be promptly killed and burned.

Care of the Coops. Economic feeding calls for vermin-free houses. The poultry business cannot be made profitable with vermin in the ascendancy. The poultryman must see to it that his birds, the males as well as the hens, are not being annoyed by vermin, or parasites of any kind. To do this the houses **must be kept clean**. The droppings must be removed as often as once a week in winter and twice a week in summer. The daily removal is better still. All litter and nesting material should be renewed as often as once a month. When vermin are suspected all such material should be burned. After thoroughly dusting the floor and wall with air slacked lime, fresh, dry material should be supplied to the nests and floor. The room will need a good whitewashing once or twice yearly. The wash should contain five per cent. of carbolic acid or creolin. This wash can be applied with a brush or spray pump. A better job can often be done with the pump. Every corner and crack should be filled with the wash. It is a good practice to scorch the perches in fire now and then, and paint the under side with carbolinium, zenoleum or some coal tar preparation. See to it that the perches are dry before they are put back in place. The system followed by the housekeeper in keeping the home tidy and orderly can very profitably be followed by the poultryman with his coops, houses, etc. The poultryman who permits himself to become negligent in these matters will sooner or later, without exception, learn his mistake. It ought always to be remembered that the general management of the poultry plant in these matters must be right or such effort as may be made along the lines of feeding and development of the flock will result only in time and money wasted.

The Runways. Runways are a prolific source of disease and should as frequently as every six months be thoroughly disinfected by giving the same a good coating of freshly slacked lime and in a few days plowed or spaded. Cultivate at intervals for a week and sow oats or other grain. When the grain has grown to be a few

inches high it may be fed down, not too closely, by the flock and given the chance to make another growth and the pasturing repeated. This practice both provides the fowls with much valuable feed and keeps the ground free from many causes of diseases.

Vermin and Parasites. Many of the ailments and diseases from which poultry suffer are traceable to vermin or parasites of some kind. These pests can be kept in subjection by the proper care of the houses and runways as before stated, and not introducing into the flocks afflicted birds.

A FEW SIMPLE REMEDIES FOR COMMON AILMENTS.

Body Lice. For body lice the birds may be dusted with Persian insect powder and sulfur, equal parts, or a combination of these with tobacco dust. The powder may be dusted among the feathers with a pepper box or with a powder gun. A little of the powder may well be mixed with the dust bath. Treat the roosting rooms, nests, etc., as explained under the heading "Care of the Coops."

Mites. There are several varieties of tiny blood sucking mites to be found in all carelessly kept poultry houses. These vermin differ from lice in that they live and breed in the cracks and crevices about the poultry house, the roosts and accumulated droppings. Many of these mites instinctively attack the fowls while on the roosts at night and hide in the cracks and joints of the perches by day. They are found in old coops that have been deserted for years. They are white or grayish in color, except when filled with blood they are red or black. They will attack all fowls, even the young chicks. They must be kept down. To combat use the "spraying emulsion" described in another place. Several applications may be necessary to exterminate them.

Dust Bath. Vermin infested poultry do not thrive well and are never profitable. In order to prevent vermin getting on the hen's body and destroying their usefulness, the fowls must have access to a dust wallow or a well supplied dust box, where they will bathe freely. The material should be very fine, light and dry. A mixture of sand, road dust and charcoal or wood ashes will do.

Scaly Legs. For this unsightly ailment soak the scabby patches with soapy water and the scabs can be easily removed by the use of a nail brush. Then scrub the legs thoroughly with kerosene.

Worms. There are many kinds of worms, viz.: the large round worm, the small round worm and the gizzard worm. When they are present they will generally be seen in the feces. The worm reproduces by laying eggs which pass out with the feces, and thus the ground and feeding places become contaminated. The eggs become mixed with the food picked up by other birds in the flock, often causing the flock to become generally afflicted with worms. Treat the rooms as stated under "Care of Coops." Scatter lime freely about

the ground and disinfect the feeding places daily. If possible change the birds to new ground. The droppings should be thoroughly mixed with air slacked lime to destroy the worms and eggs therein.

Give each afflicted bird one teaspoonful of turpentine to be followed by a tablespoonful of olive oil and 5 to 10 grains of powdered areca nut mixed with a wet mash, and fed in a clean trough often proves helpful.

Liver Disease. This quite common ailment usually results from errors in feeding. Feeding the birds on boiled potatoes mixed with meal is a very prolific cause of this trouble. Therefore, feed boiled potatoes very sparingly and give a variety of grains, plenty of green feed and exercise in the open air.

We suggest to all poultrymen that they supply themselves with a copy of Farmer's Bulletin No. 530, entitled "Important Poultry Diseases," by D. E. Salmon, D. V. M., by applying to the Secretary of Agriculture, Washington, D. C. This bulletin is free.

Spraying Emulsion. In combating the poultry house pests an emulsion made as follows may be used: One-half pound of hard soap cut into thin shavings is dissolved in six quarts of water, brought to boiling and removed from the stove. While the liquid is yet hot add eight quarts of kerosene. Churn the mixture with a spray pump or a dash churn until it changes to a soft butter like mass. Use one part of this stock emulsion to nine parts of water and apply with pump or brush. Before applying add one per cent. of concentrated carboric acid. Another convenient spray is a solution containing ninety-eight parts of water and two parts of creolin. The liquid lice killers on the market are also effective.

How to Make Whitewash. For a durable whitewash use the following for either outside or inside work. Take a clean, light barrel and put into it half a bushel of unslacked lime. Slack it by pouring hot water into the barrel, in sufficient quantity to cover the lime five inches deep. Stir briskly until thoroughly slacked, then add 2 pounds of sulphate of zinc and 2 pounds of salt, dissolved in hot water. These cause the wash to harden and it will never crack or peel off. The wash may be colored by adding ochre, lamp black, ground keel or bluing to suit. The wash may be put on either hot or cold, but hot is preferable. If for the inside of a poultry house or coop add half an ounce of carboric acid. Be careful not to get any in the eyes.

BY-PRODUCTS.

Feathers. The soft feathers of fowls have a value and at the time of picking should be kept separate from the quill feathers, and properly cured. A good way is to spread the feathers on the floor of a drying room or on a screen provided for the purpose, and held in a drying atmosphere. When thoroughly dry they may be sacked and held for an indefinite time. Good feathers are very popular in the home for making pillows, cushions, filling bed ticks, etc.

The Offal. The offal has a fertilizing value and may be preserved with the droppings as explained elsewhere, while the blood, feet and shanks may be chopped fine and mixed, cooked and used to feed the fowls. The egg shells may also be dried, crushed and fed to the fowls to advantage.

Droppings. Poultry droppings have a high fertilizing value for such crops as grass, corn, cabbage, cucumbers, onion, fruit trees, berries and garden crops in general and when used in connection with bone meal and wood ashes makes a complete fertilizer.

The Maine Experiment Station recommends the following method for securing the droppings of poultry for fertilizing purposes:

"To each 30 pounds of the manure add 10 pounds of sawdust, good dried loam or peat, 16 pounds of acid phosphate and 8 pounds of kainit. Such a mixture will contain about 1.25 per cent. of nitrogen, 4.5 per cent. of phosphoric acid, and 2 per cent. of potash, which, used at the rate of 2 tons per acre would furnish 50 pounds of nitrogen, 185 pounds of phosphoric acid, and 80 pounds of potash, and at the present price of fertilizing ingredients is worth about \$10.00 per ton. The mixture would furnish a well-balanced stable fertilizer, which, although not fine enough to work well in drills, can be successfully applied with a manure spreader. The treated manure should be well sheltered until time to apply to the land—that is, shortly before plowing."



