UNIVERSITY OF IDAHO
College of Agriculture

Poultry Feed Formulation

Starter—Broiler—Grower—
Layer—Breeder Rations

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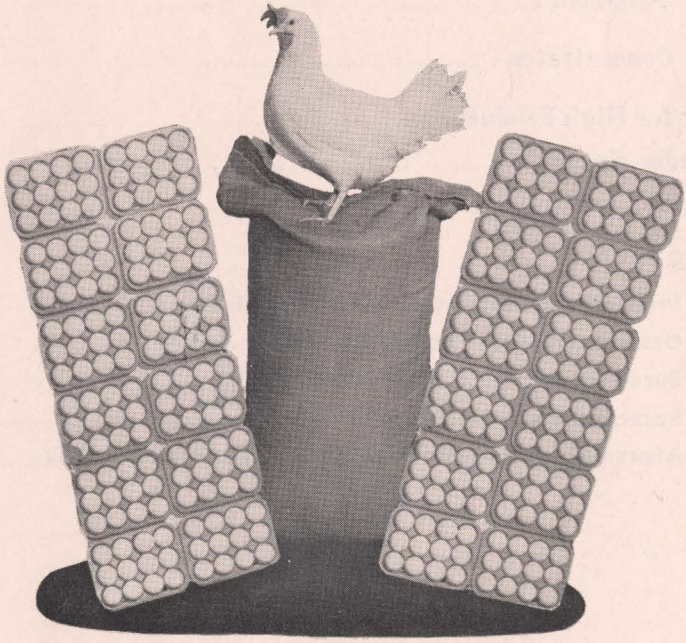

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Table of Contents

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Idaho Poultrymen, Feed Dealers and Processors

This bulletin has been prepared as an aid to all concerned with poultry production in Idaho.

To the poultryman who may wish to mix his own feed, suggested formulas in Tables 3 and 4 will give a satisfactory basis for preparing rations. For those who are buying complete rations, this bulletin provides an understanding of poultry nutrition.

Basic requirements in Table 1, suggested use of feedstuffs in Table 2, and the specific formulas have been included to aid FEED DEALERS and PROCESSORS in the preparation of rations which will result in maximum return to poultrymen.

Poultry Feed Formulation

C. F. PETERSEN AND R. E. BLACK

FEED COST AND RATE OF EGG PRODUCTION are the two most important factors in determining poultry profits. Feed represents about 60 percent of all egg production costs other than labor. Maximum profits are obtained by intelligent selection and preparation of rations and good feeding management.

About 80 percent of the feed eaten by a laying hen maintains her body. Eggs are made from the remaining 20 percent. For a hen to lay at a high rate, she must be fed a ration that contains all the essential nutrients, properly balanced and in a readily available form. Nutrient deficiencies and imbalances will not only result in poor production but may reduce vitality sufficiently to be responsible for disease outbreaks.

Feed Nutrients

The nutrients which must be present in the feed are classified as **energy sources, proteins, minerals,** and **vitamins.**

ENERGY SOURCES — The major energy sources are carbohydrates (primarily grains) and fats. Most feedstuffs contain some fat and, in addition, surplus non-edible animal fats are now available. Fats are an important source since they contain 2¼ times the energy of carbohydrates. Fiber can be used as an energy source by some animals but cannot be digested by poultry.

ENERGY USES—Energy sources are used chiefly as fuel to maintain body heat, for body activity, and to permit the bird to eat and digest food. Energy is also used in storing body fat and in making the yolk of the egg. Energy is obtained primarily from grains, which represent the major portion of the feed consumed, and is utilized almost entirely for body maintenance and not for the actual production of eggs.

Supplying adequate energy in most poultry feeds is difficult. The energy requirements for rapid growth and for high egg production under winter housing conditions are greater than can be obtained with a mixture of the usual grains and millfeeds available. Selection of grains and other energy sources on their energy content is important for two reasons. First, low energy feeds, which generally contain high levels of fiber, will not supply adequate energy and reduced growth or egg production will result. Second, low energy feeds result in greater feed consumption which may increase feed costs.

Following is a classification of energy sources based upon the ability of the products to supply poultry needs:

Very high energy — animal fats and vegetable oils.
High energy — corn, milo, wheat.
Medium energy — barley, oats, middlings.
Low energy — bran, shorts, millrun, alfalfa meal.

Specific energy values for various feeds will be found in Table 5.

PROTEINS are needed to build and replace the tissues of the body and for the production of eggs. Proteins are broken down by digestion into many compounds (amino acids). Poultry have specific requirements for certain amino acids and different crude protein sources supply different amounts of these "essential" amino acids. Therefore, protein supplements are measured on their ability to supply the essential amino acids rather than on their quantity of protein. The term, "high-quality," is applied to the supplements which more nearly supply the need of the bird for these amino acids.

Proteins are obtained from two major sources. Grains and millfeeds are the main source of energy and also supply approximately one-half of the protein needs for most poultry rations. Additional protein must be supplied with products which contain much higher percentages of protein. These supplements are generally classified as protein concentrates or protein supplements. The major products available for use in poultry feeds today are as follows:

Animal Protein Concentrates

1. Fish meal
2. Meat scraps
3. Meat and bone scraps
4. Fish solubles
5. Dried milk products
6. Liver meal

Vegetable Protein Concentrates

1. Soybean oil meal
2. Dried brewers yeast
3. Peanut oil meal
4. Corn gluten meal
5. Cottonseed oil meal
6. Sesame meal
7. Pea meal

Protein needs can also be supplied by the addition of synthetic amino acids to correct deficiencies. Two, **methionine** and **lysine,** are now available at low cost to the poultry industry. Both are generally inadequate in most concentrates. They are especially valuable in broiler and turkey starter feeds.

Soybean oil meal is available in greatest quantity. High-quality animal proteins such as fish meal, fish solubles, milk products, and liver meal are limited in supply. Therefore, soybean meal will constitute a major portion of the supplementary protein in most

rations. It is desirable to use some animal proteins in starter, broiler, and breeder rations. Their supply of essential amino acids will improve rations for growth and their content of known and unknown vitamins are necessary for breeder rations.

PROTEIN REQUIREMENTS decrease with age. Young chicks need about 20 percent protein. This need gradually declines, reaching a level of about 15 percent at maturity. However, the protein needs are related to the energy level of the ration. A ration high in energy requires a proportionately higher protein content because the bird will consume less of a high energy than of a low energy ration. This relationship has resulted in the application of the term **CALORIE-PROTEIN RATIO.** The specific ratio suggested indicates the approximate desirable number of calories per pound of feed needed for each 1 percent of protein. In terms of "productive energy" the desirable ratio for early chick growth is about 42:1. For laying hens the suggested ratio is 58:1 to 60:1. These values are preliminary and subject to revision.

VITAMINS

Many vitamins are required by birds for normal growth, body maintenance, egg production, and the hatchability of eggs. A number of vitamins are present in sufficient amounts in the usual feeds that additional fortification is not necessary. Vitamins A, D, and riboflavin must receive special attention in rations for egg production and reproduction. In addition, depending upon feed ingredients used, vitamin B_{12}, pantothenic acid, choline, and niacin may need to be included. Other vitamins that may be included in starter, broiler, and turkey starter rations are vitamins E, K, and folic acid. A slight deficiency of one or more vitamins may result in reduced growth rate, decreased feed efficiency, and reduced egg production and hatchability. Major deficiencies will interfere with vital life processes and result in poor health and death losses.

VITAMIN A promotes growth and health and is necessary for good production and hatchability. It aids in resistance to disease, especially of the respiratory tract and eyes. The usual sources are yellow corn, alfalfa meal, vitamin A and D feeding oils, and dry stabilized vitamin A. This vitamin is easily destroyed by heat, exposure to sunlight and by contact with rancid oils, air and minerals. Store this vitamin in a closed container and in a cool dark place.

VITAMIN D is needed for proper utilization of calcium and phosphorus. Adequate amounts are necessary to prevent **rickets** in young chicks and to prevent low egg production, thin-shelled

eggs, and low hatchability. Natural feeds do not supply this vitamin. Dry products containing synthetic vitamin D_3 or vitamin A and D feeding oils of various guaranteed potencies are the two common sources used. Vitamin D is more stable than vitamin A but care should be taken in storage and mixing. It should not be mixed directly with mineral materials.

RIBOFLAVIN is essential for growth and prevention of **"curled-toe"** paralysis. Hens require it for egg production and good hatchability. All natural feeds contain some, with milk products, alfalfa meal, liver meal, and various fermentation products the best sources. Synthetic riboflavin is widely used and many products, with varying concentrations, are available. The vitamin is relatively stable in mixed feeds.

VITAMIN B_{12} is required for normal growth and hatchability. Grains and vegetable proteins are poor sources, whereas, 2 to 5 percent of such animal protein concentrates as fish meal, fish solubles, liver meal, and milk products will adequately fortify most rations. Commercially-prepared B_{12} concentrates are also available at low cost.

PANTOTHENIC ACID will be adequately supplied by the usual feeds except for hatchability and for rapid growth as required with broiler and turkey poult starters. Good natural sources are liver meal, fish solubles, milk products, alfalfa meal and molasses. Synthetic calcium pantothenate preparations of various potencies are available to assure adequate formulation where needed.

CHOLINE is required for normal growth and for the prevention of perosis or slipped tendon. More is needed for the prevention of perosis than for growth. Liver meal, fish meal, some oil meals and distillers dried solubles are the best natural sources, and synthetic choline chloride is used in starter and broiler rations.

NIACIN is needed in fairly large amounts for rapid growth, good feathering, and the prevention of perosis. Most poultry rations will contain adequate niacin since barley, wheat and wheat by-products, alfalfa meal, fish meal, and meat meal are good sources. Broiler and turkey poult starter rations are exceptions and need special fortification. These rations contain large amounts of corn and milo, and both contain low levels of niacin. Supplementing these rations with synthetic niacin is essential.

VITAMIN E is essential for growth and reproduction. Young chicks suffer with a form of paralysis termed **"crazy-chick"** disease or **encephalomalacia** and also at times exhibit **exudative diathesis** in which excess water and plasma fluids accumulate under the skin

and in the muscles. The vitamin is also an antioxidant and protects other compounds including vitamin A. Eggs of breeder hens fed rations deficient in vitamin E are low in fertility and hatchability and the chicks will be more susceptable to the above diseases. Turkey poults exhibit an abnormal hock disorder resulting in cripples and mortality. Most rations will contain adequate vitamin E as cereals, dehydrated alfalfa meal and liver are good sources. However, it has become a common practice to fortify broiler, turkey starter, and all breeder rations with alpha tocopheryl acetate, a synthetic compound.

VITAMIN K is needed to assure normal blood clotting and for the prevention of hemorrhages. Although not clearly established, it appears that this vitamin may be involved in a hemorrhagic disease condition. Alfalfa meal is a rich source and as little as 2 percent alfalfa meal will generally supply adequate vitamin K.

FOLIC ACID is required for rapid growth and for the prevention of anemia. It is also needed for hatchability. Usual practical rations containing alfalfa meal and soybean meal will generally supply an adequate amount of folic acid.

MINERALS

Birds of all ages need a continuous supply of essential minerals for new bone and soft tissue. Laying hens require minerals for egg production. Common poultry feeds do not supply all the minerals needed. These include calcium, phosphorus, sodium and chlorine (salt), manganese, magnesium, potassium, iron, copper, and iodine. Special attention must be given to **salt, calcium, phosphorus, manganese** and **iodine.**

SALT requirements do not exceed 0.5 percent of the ration. Too much salt will result in increased water consumption and wet droppings. Very high levels may be poisonous.

CALCIUM and PHOSPHORUS are the two minerals which need greatest attention in properly formulating all poultry feeds. Both are required in large amounts by growing birds, and laying hens require large amounts of calcium for shell formation. A calcium-phosphorus ratio of 2:1 is desirable for growing birds to permit most efficient utilization. Bone meal and di-calcium phosphate are the usual concentrates used to supply both phosphorus and calcium. Additional calcium needs are supplied with oyster shell flour, limestone, and calcite. Free-choice feeding of whole, clean oyster shell, limestone, or calcite grit is necessary if adequate calcium is not included in laying rations.

The necessary calcium can be supplied in the mash with all-mash feeding. If the mash is to be fed with whole grain, it will

then be necessary to feed a calcium source free choice, as adequate calcium cannot be incorporated into the mash portion of the feed.

MANGANESE deficiency results in perosis, a disease of the hock joint in young birds and in thin-shelled eggs and low hatchability. Supplementary manganese as manganese sulfate is recommended.

IODINE is needed for the manufacture of thyroxine and a deficiency results in goiter. It is advisable to include iodine either as iodized salt or as a part of a trace mineral mixture.

Some Feed Additives

ANTIBIOTICS are fed either at a low level as a growth stimulant or at a high level to prevent or correct a disease condition. The addition of an antibiotic in starter feeds at low concentrations (2 to 10 grams per ton) will generally result in added growth of 5 to 10 percent. The antibiotics generally used are among the following: **penicillin, bacitracin, aureomycin, terramycin,** and **erythromycin.** High levels (50 to 200 grams per ton of feed) are sometimes fed when birds are subjected to stress as at housing time or when birds are affected with a disease for which there is no specific treatment. There is no advantage in feeding an antibiotic to laying or breeder hens except when low production or low hatchability problems exist which cannot be diagnosed or for which no specific drug is effective.

ARSENICALS are sometimes used as an additional growth stimulant, especially in broiler feeds. Care must be taken to restrict the amount to that shown in the manufacturer's directions as they are toxic compounds and excessive amounts will result in reduced growth and lameness. **Careful mixing is essential.**

An **ANTIOXIDANT** is sometimes added to broiler and breeder rations to reduce oxidation of vitamins. The two vitamins most easily destroyed are vitamins A and E. If animal fats are used, an antioxidant is essential for the maintenance of stability of both the fat and vitamins.

DRUGS are sometimes added to feeds to prevent diseases or to treat birds for specific diseases. One of several good drugs helpful in controlling outbreaks of **coccidiosis** is recommended in starter and broiler feeds. **Worms** can also be controlled through the feeding of a drug in the ration. It is often more effective to treat a specific disease outbreak by adding the drug to the water supply as birds will drink when feed consumption may be very low. Always follow the directions of the drug manufacturer for use in both feed and water.

Feeding Systems

CHICKS — Chicks should be fed a chick starter mash (preferably as crumbles) for the first 6 to 8 weeks of life. Whole grain should be started in limited quantities at 5 to 6 weeks of age. During the growing period (8-20 weeks of age) the pullets should be fed a 17 to 18 percent protein ration with about equal quantities of whole grain. Both may be fed free choice. If no whole grain is to be fed, the protein, vitamin, and mineral content of the mash can be reduced slightly. Examples are given in the tables of suggested formulas.

LAYING HENS—The two common feeding methods for laying hens reared in open pens are (1) mash-grain combination and (2) all-mash. The all-mash method is preferred for cage operations.

With the mash-grain method, the whole grain generally used is wheat or barley or a combination of these two and oats. Wheat contains more energy which may be necessary in cold climates. Barley is not readily consumed and time is required to train hens to eat this grain. More waste will result with less palatable feeds. The whole grain intake should be restricted to about 40, and never over 50, percent of the total feed consumed. Up to 60 percent mash consumption of a medium to high energy feed is desired for continued high production. The major advantages of this feeding system are (1) use of home-grown grains for farm-flock producers, (2) use of lower energy mashes if wheat is used as the whole grain, and (3) better litter conditions if whole grain is fed in litter.

ALL-MASH feeding is preferred for larger poultry operations and especially for cage-reared layers. The advantages of this system are (1) less labor is required in feeding, (2) it prevents excessive consumption of whole grain by some birds, (3) it eliminates the problem of regulating the ratio of the intake of two feeds, (4) it lends itself to bulk handling of feed which reduces labor and results in lower feed costs, and (5) its greater adaptability to mechanical feeding equipment.

Good results are obtained with either system. If feeding a commercial feed, be sure to follow the manufacturer's recommendations.

POULTRY CONCENTRATES manufactured by many feed processors, permit poultrymen to prepare a mash to be fed either with whole grain or as all-mash by mixing recommended amounts of ground grains with the concentrate. These concentrates are of greatest value when they contain the needed amounts of vitamins, minerals, antibiotics, and other desired products, in addition to the protein supplements.

Feeding For High Production

Full feeding of a balanced ration is necessary for maximum production. The amount of feed consumed varies with laying house temperature, size and age of birds, completeness of ration, energy content of ration, and rate of egg production.

Leghorn flocks in heavy production will eat 25 to 28 pounds of feed per 100 hens daily. For heavy breeds the figure will vary from 28 to 32 pounds. Maximum feeding is of greatest importance with young pullets in heavy production when body gains are also great. Increased mash consumption can be obtained by feeding pellets once daily or feeding a moist mash. Two to 4 pounds of pellets per 100 birds daily can be used to avoid a drop in production or to correct reduced feed intake.

Many companies prepare a special feed fortified with additional high quality proteins, vitamins, antibiotics, and other drugs for maintaining high production. This type of feed is used successfully as a daily "top dressing," as a complete feed for 3 to 5 days at regular intervals or under conditions of stress as at housing time or exposure to diseases.

FEEDER SPACE—Reduced egg production results when insufficient feeder space is provided. When troughs or hoppers are used, provide a minimum of 32 feet of space for 100 hens. More is preferred. With mechanical feeders, less space appears to be needed.

WATER—Birds consume about twice as much water as feed by weight. Birds will slump in egg production and go into a molt faster from a lack of water than from any other factor. Water fountains should be located within 10 feet of the feeding area and located to reduce bird traffic across the litter. Location of both feed and water equipment on the roosting rack is most desirable.

Table 1 — Practical Nutrient Levels For Poultry Mashes

NUTRIENTS	STARTER BROILER All-Mash	GROWER All-Mash	GROWER Mash-Grain	LAYER All-Mash	LAYER Mash-Grain	BREEDER All-Mash	BREEDER Mash-Grain
Protein — %	20-22	15	18	15-16	20	15-16	20
Crude fiber (max.)—%	4-5	6-7	7-8	6	7	6	7
Productive energy (Cal. per lb.)	850-1000	750-900	*	750-1000	*	750-1000	*
Minerals							
Calcium—%	1.0-1.3	1.0-1.4	1.5-2.0	3.0[1]	2.5[2]	3.0[1]	2.5[2]
Phosphorus[3]—%	0.6	0.6	0.9	0.75	1.2	0.75	1.2
Vitamins (per lb. feed)							
Vit. A.—U.S.P. Units	3000	3000	5000	3300	6600	4000	7000
Vit. D_3—I.C. Units	200	200	400	340	680	400	800
Riboflavin, mg.	2.0	1.0	1.6	1.2	2.0	2.2	4.0
Vit. B_{12}, micrograms	4.0	2.0	4.0	1.0	2.0	2.5	5.0
Niacin, mg.	16.0	16.0	16.0	—	—	—	—
Pantothenic acid, mg.	5.0	5.0	7.0	2.5	4.0	5.0	7.0
Choline, mg.	600.0	—	—	—	—	—	—
Vitamin E, I. Units	5.0	—	—	—	—	8.0	10.0

* Productive energy content of these rations will depend upon the whole grain fed. See text.
[1] This amount of calcium will meet requirements and whole shell feeding will not be essential.
[2] Free choice feeding of whole oyster shell is needed.
[3] At least 0.45% of total feed should be inorganic phosphorus (non-plant feed ingredients).

Table 2 — General Guide For Formulating Poultry Rations

INGREDIENTS	STARTER All-Mash	GROWER All-Mash	GROWER Mash-Grain	LAYER All-Mash	LAYER Mash-Grain	BREEDER All-Mash	BREEDER Mash-Grain
Cereal Grains and Millfeeds	per-cent	per-cent	per-cent	per-cent	per-cent	per-cent	per-cent
High energy products (corn, milo, wheat, etc.)	45-65	20*	20*	30*	15*	30*	15*
Medium and low energy products (barley, oats, middlings, bran, etc)	0-20	0-50	0-50	0-40	0-50	0-40	0-50
Stabilized Fats	0-5	0-5	0-5	0-5	0-5	0-5	0-5
Protein Concentrates							
Animal proteins (fish meal, meat scraps, milk products, fish solubles, etc.)	2.5-10	1.5-5	2.5-10	2.5-10	5-15	5-10	7.5-15
Vegetable proteins (soy-bean meal, corn gluten meal, cottonseed meal, etc.)	15-25	10-15	15-20	5-15	10-20	5-12.5	10-17.5
Dehydrated Alfalfa Meal	2.5-5	2.5-5	5	2-4	5-7.5	2-4	5-7.5
Additional Vitamin A, D_3, B_{12}, riboflavin, niacin, calcium pantothenate as needed	add	add	add	add	add	add	add
Mineral Supplements							
Calcium-phosphorous supplements	2-5	2-4	3-5	3-6	3-6	3-5	3-5
Salt, iodized	0.5	0.5	1	0.5	1	0.5	1
Manganese sulfate (70%)	0.02	0.02	0.025	0.02	0.04	0.02	0.04
Antibiotic Feed Supplement	use	optional	optional	(see text)		(see text)	
Coccidiostat Drug	use	use	use	no	no	no	no

* These levels may be increased with corresponding reduction in other grains.

Table 3 — Suggested Formulas For Young Birds

INGREDIENTS		STARTER	BROILER		GROWER			
					All-Mash		With Grain[4]	
		All-Mash 1-6 Weeks	Starter 1-6 Weeks	Finisher 7-9 Weeks	Low Energy	High Energy	Low Energy	High Energy
Corn, ground yellow	lbs.	500	600	500	100	450	100	400
Wheat, ground	lbs.	—	—	—	—	—	—	—
Barley, ground	lbs.	100	—	200	450	250	350	200
Oats, ground	lbs.	75	—	—	150	100	100	100
Wheat bran or millrun	lbs.	—	—	—	100	—	150	—
Stabilized animal fat	lbs.	—	25	25	—	—	—	—
Dehyd. alfalfa meal	lbs.	25	25	25	50	30	75	50
Fish meal	lbs.	50	50	25	20	20	20	20
Meat and bone scraps	lbs.	50	50	50	25	50	50	100
Soybean oil meal	lbs.	175	225	150	75	75	125	100
Dried whey	lbs.	25	25	20	—	—	—	—
Di-calcium phosphate*	lbs.	10	10	10	10	10	10	10
Limestone**	lbs.	10	10	10	15	10	25[4]	15[4]
Salt, iodized	lbs.	5	5	5	5	5	10	10
Manganese sulfate	lbs.	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.25)	(0.25)
Multivitamin supplement[1]	lbs.	1	1	1	—	—	—	—
Riboflavin	mg.	1,000	1,000	1,000	250	250	1,000	1,000
Vitamin A	U.S.P. Units	1,500,000	1,500,000	1,500,000	500,000	1,200,000	1,000,000	2,000,000
Vitamin D_3	I.C. Units	200,000	200,000	200,000	200,000	200,000	400,000	400,000
Antibiotic[2]		+	+	+	—	—	—	—
Coccidiostat[3]		+	+	+	—	—	—	—
TOTAL POUNDS		1,026	1,026	1,021	1,000	1,000	1,015	1,005

[1] Multivitamin supplement to contain approximately the following vitamins in milligrams per pound or equivalent: calcium pantothenate 2000, niacin 6000, choline chloride 20,000, vitamin E 1500, vitamin B_{12}—2. Vitamin A and D and riboflavin may also be included in this supplement.

[2] Add either 5 grams of aureomycin, terramycin, bactiracin or erythromycin or 2 grams of peniciilin per 1000 pounds of starter and broiler feeds.

[3] Generally accepted practice to add a coccidiostat at preventive level in starter and broiler feeds. Use amount according to direction of the supplier of the specific drug selected.

[4] Feed whole oyster shell or calcite free-choice with mashes which are to be fed with whole grain.

* Steam bone meal or defluorinated phosphate may be used in place of di-calcium phosphate.

** Oyster shell flour may be used in place of limestone.

Table 4—Suggested Formulas For Laying Birds

INGREDIENTS		LAYER—ALL MASH[6] Medium Energy	High Energy	LAYER—WITH GRAIN[5-6] Medium Energy	High Energy	BREEDER[6] All-Mash	BREEDER Mash-Grain[5 6]
Corn, ground yellow[1]	lbs.	200	500	——	300	400	300
Wheat, ground[1]	lbs.	——	——	——	——	——	——
Barley, ground[1]	lbs.	400	150	400	300	300	250
Oats, ground[1]	lbs.	100	100	100	50	——	100
Wheat bran or millrun	lbs.	100	——	150	——	50	——
Stabilized animal fat	lbs.	——	——	——	——	——	——
Dehyd. alfalfa meal	lbs.	25	25	75	50	30	60
Fish meal	lbs.	15	15	25	25	40	80
Meat and bone scraps	lbs.	50	50	100	100	50	75
Soybean oil meal	lbs.	75	100	100	150	50	75
Dried whey	lbs.	——	——	——	——	20	30
Di-calcium phosphate[2]	lbs.	10	10	10	20	10	20
Limestone[3 6]	lbs.	50	50	30	20	50	20
Salt, iodized	lbs.	5	5	10	10	5	10
Manganese sulfate	lbs.	0.2	0.2	0.4	0.4	0.2	0.4
Multivitamin supplement[4]	lbs.	——	——	——	——	1.0	2.0
Riboflavin	mg.	500	500	500	750	1,500	2,750
Vitamin A	U.S.P. Units	2,000,000	2,000,000	2,000,000	3,600,000	2,200,000	3,500,000
Vitamin D_3	I.C. Units	350,000	350,000	700,000	700,000	400,000	800,000
TOTAL POUNDS		1,030	1,005	1,000	1,025	1,006	1,022

[1] Ground corn may replace barley and oats. Ground wheat may replace ground barley
Ground wheat may replace ¼ of ground corn. Ground milo may replace ½ of ground corn.

[2] Bone meal or defluorinated phosphate may replace di-calcium phosphate.

[3] Oyster shell flour may be used in place of limestone.

[4] Multivitamin mix to contain same levels as listed in Table 3.

[5] Whole grains preferred are wheat or corn. Whole oats and barley should not exceed over 1/3 of a grain mixture unless high-energy mash is fed.

[6] Whole oyster shell feeding with the ALL-MASH rations is **not** needed if these formulas are used. Whole oyster shell feeding with MASH-GRAIN rations is needed with these formulas.

Table 5 — Approximate Composition of Common Poultry Feedstuffs

Manganese	Phosphorus	Calcium	Ash	Fat	Fiber	Protein	Feedstuff	Calories/Lb.		Vitamin A	Riboflavin	Niacin	Pantothenic Acid	Choline
Mg./lb.	percent	percent	percent	percent	percent	percent		M.E.[1]	P.E.[1]	U.S.P.U./lb.	Mg./lb.	Mg./lb.	Mg./lb.	Mg./lb.
14.0	0.20	1.50	10.0	2.5	27.0	17.0	Alfalfa meal, dehyd.	640	250	60,000[2]	6.5	12.0	12.0	400
12.0	0.20	1.40	9.0	2.0	30.0	15.0	Alfalfa meal, suncured	600	240	30,000[2]	5.0	13.0	13.0	400
7.0	0.36	0.05	2.7	2.0	6.0	10.0	Barley	1310	810		0.5	28.9	3.5	540
2.5	1.50	0.11	6.9	1.0	2.8	46.0	Brewers dried yeast	1000	700		17.0	200.0	49.0	1700
2.2	0.27	0.02	1.4	4.0	2.0	8.8	Corn, yellow	1600	1140	1,500	0.5	10.3	2.2	225
4.0	0.40	0.17	3.0	2.0	3.9	42.5	Corn gluten meal	1180	820	10,000	0.5	24.0	4.4	200
8.0	1.20	0.19	6.5	4.5	12.5	41.0	Cottonseed meal	1100	650		2.5	15.0	4.7	1260
35.0	1.30	0.45	8.0	6.5	3.3	26.0	Distillers solubles, dried	1300	850		6.0	52.0	10.0	2400
—	—	—	—	100.0	—	—	Fat, stabilized	3300	2880		—	—	—	—
—	0.79	0.24	3.3	2.7	1.0	80.0	Feather meal	1400	1000		1.0	35.0	4.1	1500
4.5	2.50	3.80	14.5	7.2	0.5	70.0	Fish meal, herring	990	900		4.5	40.0	5.2	1600
10.0	2.40	4.60	15.5	5.3	0.5	65.0	Fish meal, sardine	990	900		3.0	28.0	4.2	1350
5.5	0.75	0.20	10.0	5.2	—	33.0	Fish solubles, condensed	500	450		6.6	140.0	16.1	1500
8.0	5.00	10.00	29.0	9.5	2.2	50.0	Meat and bone scraps	910	720		2.0	22.0	2.2	880
4.5	4.00	8.00	22.0	9.2	2.2	55.0	Meat scraps	930	730		2.5	22.0	2.2	1050
1.0	1.00	1.30	7.8	1.0	0.2	35.0	Milk, dried skim	1150	550		10.0	5.2	15.3	600
7.0	0.30	0.03	2.0	3.0	2.0	10.0	Milo	1550	1100		0.5	14.8	4.6	200
15.0	0.35	0.10	3.6	5.0	11.0	10.0	Oats	1200	750		0.5	7.0	5.8	400
—	0.19	0.55	3.7	1.5	8.8	22.5	Peas	1200	890		—	14.4	—	295
14.0	0.64	0.28	5.7	1.0	5.6	44.0	Soybean oil meal, solvent	1040	560		1.5	12.0	6.6	1247
14.0	0.62	0.25	5.6	0.7	2.8	50.0	Soybean oil meal, dehulled	1100	660		1.5	12.0	6.6	1330
14.0	0.40	0.05	2.0	2.0	2.7	12.0	Wheat, hard	1520	1000		0.5	25.0	5.5	450
14.0	0.40	0.05	2.0	2.0	2.8	10.0	Wheat, soft	1520	1000		0.5	25.0	5.0	450
55.0	1.25	0.12	5.5	4.0	10.0	14.0	Wheat bran	540	480		1.4	60.0	13.2	490
25.0	1.00	0.10	4.6	4.3	8.0	15.0	Wheat, millrun	540	475		1.0	50.0	6.0	440
6.0	0.76	0.89	10.0	1.0	—	12.0	Whey, dried	850	490		13.0	5.1	22.0	800
5.3	14.00	30.00	78.0	4.0	1.0	7.0	Bone meal, steamed	——	200		—	2.0	0.8	—
—	18.00	26.00	100.0	—	—	—	Di-calcium phosphate	——	——		—	—	—	—
117.0	—	38.00	96.0	—	—	—	Limestone	——	——		—	—	—	—
60.5	—	38.00	81.0	—	—	—	Oyster shell flour	——	——		—	—	—	—

[1]M.E. and P.E. represent Metabolizable and Productive Energy values, respectively.

[2]These values for vitamin A are averages; actual values may be considerably higher or lower.

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