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Chicken Rations

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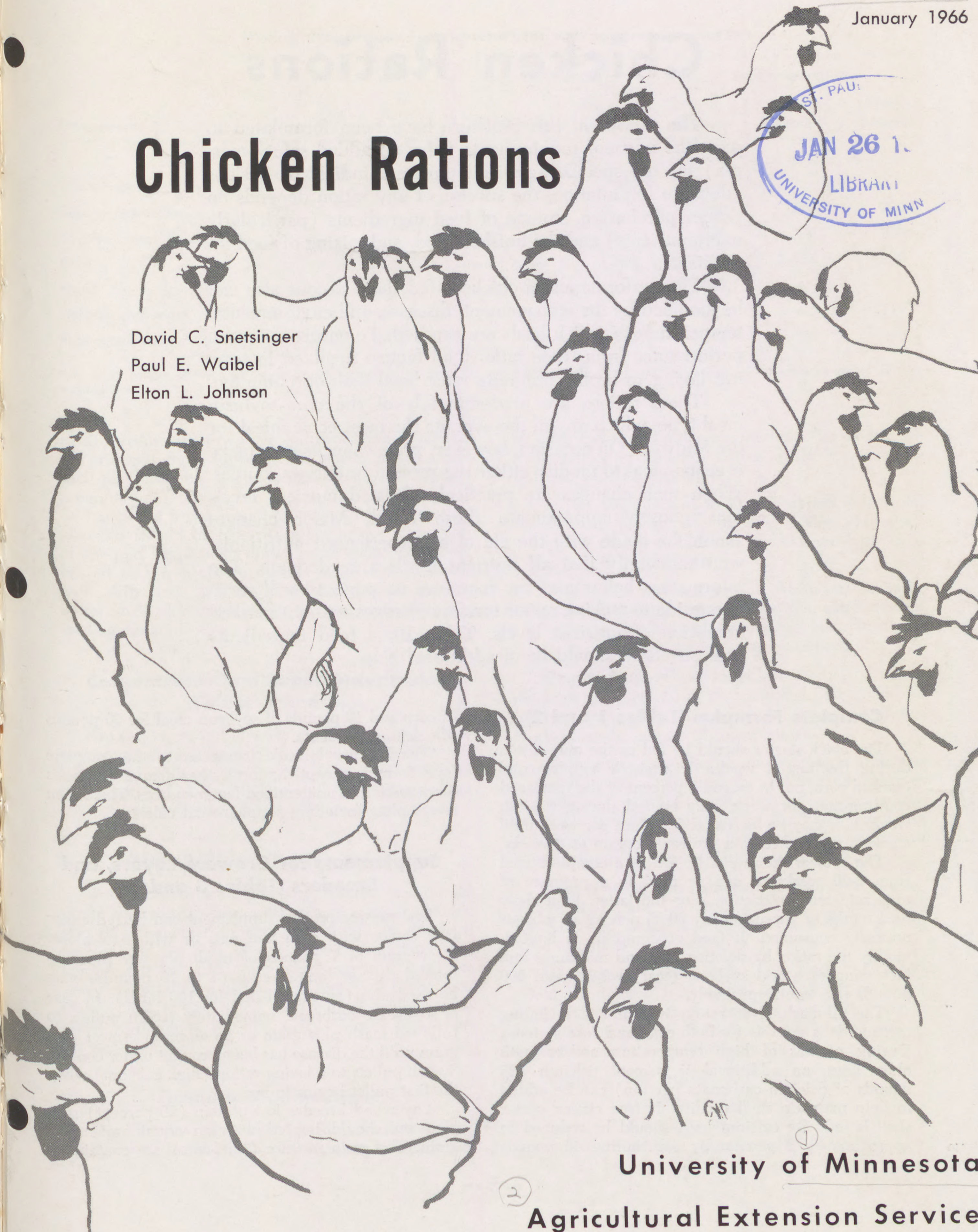

University of Minnesota
Agricultural Extension Service

Chicken Rations

The rations in this brochure have been formulated to meet the nutrient requirements (plus an added safety margin) for the specific ages and purposes indicated. Besides adequate formulation, the success of any ration depends on proper purchasing, storage of feed ingredients (particularly micronutrients) and the finished feed, and mixing of feed ingredients.

The performance of chickens fed these rations also can be modified by the management, diseases, and environmental temperature to which birds are exposed. To ensure optimum performance from these rations, all factors involved in rearing, laying, or broiler programs must be at their optimum too.

These rations are predominately of the corn-soybean meal type, which are on the average the most economical for the Midwest. On occasion, however, price changes may make it economical to modify either the protein or energy sources. When such changes are practical, adjusted nutrient levels must closely approximate those listed. Major changes should be made with the aid of an experienced nutritionist who can verify that all nutrient levels are adequate. The information below and the footnotes on page 10 will serve as a guide in making minor formula changes without marked alteration of nutrient levels. Table 10, a feed ingredients analysis chart, should be of additional help.

Complete Formulas (Tables 1 and 2)

The chick starter should be fed as the only ration during the first 4 weeks. If desired, supplemental cracked corn, not to exceed 5 percent of the total feed consumption per week, may be fed during the 5th week. This may be increased 5 percent per week until chicks are switched to a grower program at 8 weeks.

The grower ration can be fed as a complete feed from 8-20 weeks of age or used in a program of moderate feed restriction. For the latter, limit daily feed intake to approximately 80-85 percent of what is normally consumed. If feed consumption is limited, modify the ration by deleting oats and middlings and increasing corn and soybean meal to 1,550 and 260 pounds per ton, respectively.

The all-mash layer ration is complete including calcium. It is suitable for both cage and floor systems. During periods of high temperature and/or with older hens, an additional ½ percent calcium (25 pounds of calcium carbonate per ton) can be added to help maintain shell quality. If free choice oyster shell is fed, the calcium level should be reduced to approximately 2 percent by substituting 40 pounds of corn and 10 pounds of soybean meal for 50 pounds of calcium carbonate.

The breeder formula is similar to the complete layer formula except the former has greater potencies of vitamins and unidentified factor sources. This ration is complete including supplemental calcium.

Supplements for Growers, Layers, and Breeders (Tables 3 and 4)

The grower protein supplement can be fed either free choice with corn and oats or with oats alone. A program of 7 pounds of mash per day plus unlimited oats or limited corn (4 to 10 pounds) may be used also (amounts listed for 100 birds). In case of a disease outbreak, immediately return pullets to full-feed mash plus grain or an all-mash grower program until the disease has been brought under control. Switch pullets to a laying ration (high calcium) when the first pullet begins to lay.

Layer and breeder low-protein (20 percent) supplements should be fed with an equal amount of grain. The grain mixture (corn-oats) can contain up

Mixing proportions for concentrates and superconcentrates

Component	Concentrates		Superconcentrates		
	Grower	Layer or breeder	Grower	Layer or breeder	Layer or breeder
			pounds		
Concentrate	500	500	....	....	....
Superconcentrate	....	....	250	200	200
Soybean meal, 44 percent	....	....	250	375	350
Corn	1,000	1,500	1,000	1,425	1,340
Oats*	500	....	500	....	....
Calcium carbonate	....	....	....	....	110
Free choice calcium required	No	Yes	No	Yes	No

* Up to 50 percent of the grain in the grower ration can be oats. For use of oats in laying and breeding rations, see comments on general formula modifications.

to 30 percent oats. In winter, however, corn should be the principal grain. Supplemental calcite grit or oyster shell plus insoluble grit is required with this feeding program.

Layer and breeder high-protein (27 percent) supplements should be fed with grain in the proportion of one part supplement to two parts grain. They may be fed in a free choice manner with corn alone or with corn and oats. Supplemental calcite grit or oyster shell plus insoluble grit is required with this feeding program also.

Concentrates And Superconcentrates (Tables 5 and 6)

Grower, layer, and breeder concentrates and superconcentrates should **not** be fed alone or free choice, but mixed with grains in the proportions outlined above and fed as a complete feed. Note that certain mixtures require free choice calcium supplements.

Broiler Rations (Tables 7 and 8)

Broiler rations are high-energy rations that should not be diluted with oats or other low-energy feedstuffs. If highly pigmented broilers are not desired, decrease or eliminate the corn gluten meal in the starter and finisher rations. Add a pound of soybean meal for every pound of corn gluten meal removed. If the corn gluten meal is eliminated, also add ½ million more units of vitamin A per ton. Supply broiler finisher at 5½ weeks of age.

Formula Modifications

The formulas given here can be varied to higher energy levels by adding fat and to lower energy levels by adding oats and milling byproducts. To modify all-mash rations or all-mash rations made from concentrates or superconcentrates:

(1) Substitute up to 30 percent oats in the total ration in any formula. Delete 9 pounds corn and 1 pound soybean meal for each 10 pounds oats.

(2) Add up to 3 percent fat to any formula, **following the calorie-protein ratio concept carefully.** Add 4 pounds soybean meal plus 5 pounds fat to replace 9 pounds corn.

Form of feed—These formulas may be fed in the meal form, as pellets, or as crumbles. Grit should be used in rations that include whole or cracked grains. It also may be used with complete feeds.

Medication—Coccidiostat and antibiotic additions should be made where necessary. Most feed additives or medicants, whether added singly or in combination, are controlled by regulations of the Food and Drug Administration—adherence to these regulations and to manufacturers' recommendations is mandatory.

Feed consumption data and performance rates—Tables 11, 12, and 13 offer reasonable approximations for feed and water consumption as well as growth rates of pullets and broilers.

Management information—See Table 14. Additional information is available from the Department of Poultry Science in the form of fact sheets and a bimonthly newsletter. Turkey formula charts and information can also be obtained.

Write to: Department of Poultry Science
Institute of Agriculture
University of Minnesota
St. Paul, Minnesota 55101

Table 1. Complete chicken rations

Ingredients	Starter	Grower[1]	Layer[2]	Breeder[2]
	pounds per ton			
Corn, ground yellow	1,165	890	1,340	1,350
Oats, ground[3]	100	500	....	....
Wheat standard middlings	....	300	....	....
Soybean meal, 44%	500	120	350	330
Meat and bone meal, 50%[4]	80	50	50	50
Fish solubles, carrier dried[5]	40	30	30	40
Whey, dried whole or partially delactosed	30	20	30	40
Alfalfa meal, 17% dehydrated, 100,000 I.U. vit. A/℔	50	50	50	50
Dicalcium phosphate[6]	20	20	30	25
Calcium carbonate[7]	10	15	115	110
Salt, iodized	5.0	5.0	5.0	5.0
Manganese sulfate, 27% Mn[8]	0.5	0.5	0.5	0.5
Zinc oxide, 70% Zn[8]	0.05	0.05	0.05	0.05
Vitamin supplements[9]:	amount added per ton			
Vitamin A (I.U.)	4,000,000	3,500,000	4,000,000	5,000,000
Vitamin D_3 (I.C.U.)	1,000,000	900,000	1,400,000	1,600,000
Vitamin E (I.U.)	4,000	....	....	5,000
Vitamin K (g.)	2.0	1.0	1.0	2.0
Riboflavin (g.)	2.5	2.0	3.0	4.0
Calcium pantothenate (g.)	5.0	4.0	6.0	7.0
Niacin (g.)	15.0	12.0	14.0	18.0
Choline chloride (g.)	227.0	....	....	....
Vitamin B_{12} (g.)	0.008	0.006	0.006	0.008
Folic acid (g.)	0.5	....	....	0.5
Feed additives[10]:				
Coccidiostat	+	±	—	—
Antioxidant	±	±	±	±
Antibiotic	+	±	±	±
Total[11]	2,000.6	2,000.6	2,000.6	2,000.6

For footnotes, see page 10.

Table 2. Composition of complete chicken rations

Nutrient	Unit	Starter	Grower	Layer	Breeder
Metabolizable energy	Cal. per ℔	1,271	1,214	1,251	1,258
Protein	Percent	20.35	14.74	16.17	16.12
Calorie/protein ratio	....	62.5	82.4	77.4	78.0
Crude fiber	Percent	3.94	5.68	3.07	3.04
Crude fat	Percent	3.28	4.09	3.16	3.18
Calcium	Percent	0.97	0.89	2.90	2.76
Phosphorus, total	Percent	0.73	0.70	0.72	0.67
Phosphorus, inorganic[12]	Percent	0.48	0.43	0.51	0.46
Vitamin A	I.U. per ℔	5,080	4,700	5,170	5,675
Vitamin D_3	I.C.U. per ℔	500	450	700	800
Riboflavin	mg. per ℔	2.67	2.09	2.77	3.42
Pantothenic acid	mg. per ℔	7.18	7.62	6.98	7.70
Niacin	mg. per ℔	21.79	22.98	19.47	21.96
Choline	mg. per ℔	695	433	455	464

For footnotes, see page 10.

Table 3. Supplements for free choice or controlled grain feeding[13]

Ingredients	Grower	Layer: Low protein	Layer: High protein	Breeder: Low protein	Breeder: High protein
	pounds per ton				
Corn, ground yellow	600	960	530	975	510
Oats, ground[3]	300	...	...	...	...
Wheat, standard middlings	250	...	...	...	...
Soybean meal, 44%	485	585	790	530	750
Meat and bone meal, 50%[4]	100	100	150	100	150
Fish solubles, carrier dried[5]	40	60	90	80	120
Whey, dried whole or partially delactosed	40	60	90	80	120
Alfalfa meal, 17% dehydrated, 100,000 I.U. vit. A/℔	100	100	150	100	150
Dicalcium phosphate[6]	40	45	65	45	65
Calcium carbonate[7]	35	80	120	80	120
Salt, iodized	10	10	15	10	15
Manganese sulfate, 27% Mn[8]	1.0	1.0	1.5	1.0	1.5
Zinc oxide, 70% Zn[8]	0.1	0.1	0.15	0.1	0.15
Vitamin supplements[9]:	amount added per ton				
Vitamin A (I.U.)	7,000,000	8,000,000	12,000,000	10,000,000	15,000,000
Vitamin D_3 (I.C.U.)	1,800,000	2,800,000	4,200,000	3,200,000	4,800,000
Vitamin E (I.U.)	...	...	...	10,000	15,000
Vitamin K (g.)	2.0	2.0	3.0	4.0	6.0
Riboflavin (g.)	5.0	6.0	9.0	8.0	12.0
Calcium pantothenate (g.)	10.0	12.0	18.0	14.0	21.0
Niacin (g.)	30.0	28.0	42.0	36.0	54.0
Vitamin B_{12} (g.)	0.012	0.012	0.018	0.016	0.024
Folic acid (g.)	...	...	...	1.0	1.5
Feed additives[10]:					
Coccidiostat	±	—	—	—	—
Antioxidant	±	±	±	±	±
Antibiotic	±	±	±	±	±
Total[11]	2,001.1	2,001.1	2,001.7	2,001.1	2,001.7

For footnotes, see page 10.

Table 4. Calculated nutrient composition of supplements

Nutrient	Unit	Grower	Layer: Low protein	Layer: High protein	Breeder: Low protein	Breeder: High protein
Metabolizable energy	Cal. per ℔	1,074	1,150	997	1,153	991
Protein	Percent	22.00	21.79	27.98	22.32	28.07
Calorie/protein ratio	...	48.8	52.8	35.6	51.7	35.3
Crude fiber	Percent	5.94	3.98	4.99	3.98	4.89
Crude fat	Percent	3.38	2.93	2.54	2.95	2.54
Calcium	Percent	1.82	2.75	4.09	2.77	4.12
Phosphorus, total	Percent	1.04	1.01	1.33	1.03	1.35
Phosphorus, inorganic[12]	Percent	0.75	0.79	1.10	0.81	1.13
Vitamin A	I.U. per ℔	8,830	9,480	13,765	10,487	15,255
Vitamin D_3	I.C.U. per ℔	900	1,400	2,100	1,600	2,400
Riboflavin	mg. per ℔	4.42	5.01	7.34	6.31	9.20
Pantothenic acid	mg. per ℔	11.25	11.32	15.60	12.77	17.75
Niacin	mg. per ℔	32.57	33.31	38.99	34.53	46.74
Choline	mg. per ℔	620	638	849	670	883

For footnotes, see page 10.

Table 5. Concentrates and superconcentrates for growers, layers, and breeders[13]

Ingredient	Grower Concentrate	Grower Superconcentrate	Layer Concentrate	Layer Superconcentrate	Breeder Concentrate	Breeder Superconcentrate
	pounds per ton					
Soybean meal, 44%	960	...	1,120	...	1,040	...
Wheat standard middlings	300	520	...	...	...	...
Meat and bone meal, 50%	200	400	200	500	200	350
Fish solubles, carrier dried[5]	120	240	120	300	160	400
Whey, dried whole or partially delactosed	80	160	120	300	160	400
Alfalfa meal, 17% dehydrated, 100,000 I.U. vit. A/℔	200	400	200	500	200	500
Dicalcium phosphate[6]	80	160	115	295	100	300
Calcium carbonate[7]	40	80	105	55	120	...
Salt, iodized	20	40	20	50	20	50
Manganese sulfate, 27% Mn[8]	2.0	4.0	2.0	5.0	2.0	5.0
Zinc oxide, 70% Zn[8]	0.2	0.4	0.2	0.5	0.2	0.5
Vitamin supplements[9]:	amount added per ton					
Vitamin A (I.U.)	14,000,000	28,000,000	16,000,000	40,000,000	20,000,000	50,000,000
Vitamin D_3 (I.C.U.)	3,600,000	7,200,000	5,600,000	14,000,000	6,400,000	16,000,000
Vitamin E (I.U.)	...	...	...	...	20,000	50,000
Vitamin K (g.)	4	8	4	10	8	20
Riboflavin (g.)	8	16	12	30	16	40
Calcium pantothenate (g.)	16	32	24	60	28	70
Niacin (g.)	48	96	56	140	72	180
Vitamin B_{12} (g.)	0.024	0.048	0.024	0.060	0.032	0.080
Folic acid (g.)	...	...	...	...	2.0	5.0
Feed additives[10]:						
Coccidiostat	±	±	—	—	—	—
Antioxidant	±	±	±	±	±	±
Antibiotic	±	±	±	±	±	±
Total[11]	2,002.2	2,004.4	2,002.2	2,005.5	2,002.2	2,005.5

For footnotes, see page 10.

Table 6. Calculated nutrient composition of concentrates and superconcentrates

Nutrient	Unit	Grower Concentrate	Grower Superconcentrate	Layer Concentrate	Layer Superconcentrate	Breeder Concentrate	Breeder Superconcentrate
Metabolizable energy	Cal. per ℔	863	613	832	657	830	657
Protein	Percent	34.52	26.10	35.75	27.79	35.41	27.46
Calorie/protein ratio	...	25.0	23.5	23.3	23.6	23.4	23.9
Crude fiber	Percent	6.29	7.38	6.12	7.09	5.97	7.05
Crude fat	Percent	2.65	4.26	2.06	3.76	2.08	3.15
Calcium	Percent	3.65	7.03	4.76	9.09	4.89	6.00
Phosphorus, total	Percent	1.65	2.77	1.96	4.17	1.83	3.98
Phosphorus, inorganic[12]	Percent	1.38	2.61	1.78	4.12	1.64	3.98
Vitamin A	I.U. per ℔	17,000	34,000	18,000	45,000	20,000	50,000
Vitamin D_3	I.C.U. per ℔	1,800	3,600	2,800	7,000	3,200	8,000
Riboflavin	mg. per ℔	7.02	12.85	9.58	21.97	12.15	28.37
Pantothenic acid	mg. per ℔	15.89	26.30	20.10	41.58	22.92	49.16
Niacin	mg. per ℔	49.18	82.38	48.17	99.01	59.34	100.24
Choline	mg. per ℔	858	616	1,004	944	1,134	1,078

For footnotes, see page 10.

Table 7. Broiler starter and finisher rations

Ingredients	Broiler starter (0-5½ weeks)	Broiler finisher (5½-9 weeks)
	pounds per ton	
Corn, ground yellow	1,090	1,213
Fat, stabilized[14]	80	80
Soybean meal, dehulled, 50%	500	330
Meat and bone meal, 50%[4]	100	100
DL-methionine or methionine hydroxy analog	0.5	0.5
Fish solubles, carrier dried[5]	50	50
Whey, dried whole or partially delactosed	50	50
Alfalfa meal, 17% dehydrated, 100,000 I.U. vit. A/℔	50	50
Corn gluten meal	50	100
Dicalcium phosphate[6]	15	15
Calcium carbonate[7]	10	7.0
Salt, iodized	5.0	5.0
Manganese sulfate, 27% Mn[8]	0.5	0.5
Zinc oxide, 70% Zn[8]	0.05	0.05
Vitamin supplements[9]:	amount added per ton	
Vitamin A (I.U.)	4,000,000	3,500,000
Vitamin D_3 (I.C.U.)	1,000,000	1,000,000
Vitamin E (I.U.)	5,000	5,000
Vitamin K (g.)	2.0	2.0
Riboflavin (g.)	3.5	3.0
Calcium pantothenate (g.)	7.0	6.0
Niacin (g.)	21.0	18.0
Choline chloride (g.)	454	454
Vitamin B_{12} (g.)	0.010	0.010
Folic acid (g.)	0.5	0.5
Feed additives[10]:		
Coccidiostat	+	+
Antioxidant	+	+
Antibiotic	+	+
Total[11]	2,000.6	2,000.6

For footnotes, see page 10.

Table 8. Calculated nutrient composition of broiler rations

Nutrient	Unit	Starter	Finisher
Metabolizable energy	Cal. per ℔	1,383	1,414
Protein	Percent	23.19	20.24
Calorie/protein ratio	....	59.6	69.9
Crude fiber	Percent	2.72	2.80
Crude fat	Percent	7.07	7.30
Calcium	Percent	1.03	0.94
Phosphorus, total	Percent	0.71	0.69
Phosphorus, inorganic[12]	Percent	0.48	0.48
Vitamin A	I.U. per ℔	5,292	5,360
Vitamin D_3	I.C.U. per ℔	500	500
Riboflavin	mg. per ℔	3.45	3.13
Pantothenic acid	mg. per ℔	8.29	7.52
Niacin	mg. per ℔	25.58	23.86
Choline	mg. per ℔	870	812

For footnotes, see page 10.

Table 9. Vitamin premixes for 1 ton of complete ration[15]

Vitamin (potency)	Starting	Growing	Laying	Breeding
	grams			
Vitamin A (30,000 I.U./g.)	135	115	135	170
Vitamin D (15,000 I.C.U./g.)	70	60	95	110
Vitamin E (20,000 I.U./℔)	91	0	0	113
Vitamin K (16 g./℔)	57	28	28	57
Riboflavin (16 g./℔)	71	57	85	113
Calcium pantothenate (32 g./℔)	71	57	85	100
Niacin (50%)	30	24	28	36
Choline chloride (50%)	454	0	0	0
Vitamin B_{12} (20 mg./℔)	182	136	136	182
Folic acid (3%)	17	0	0	17
Finely ground corn	3,362	4,063	3,948	3,659
Total (g.)	4,540	4,540	4,540	4,540
Total (℔)	10	10	10	10

For footnotes, see page 10.

Table 10. Feed ingredients analysis chart

Ingredient	Protein	Energy		Fat	Fiber	Calcium	Phosphorus
		Productive	Metabolizable				
	percent	Calories/lb		percent			
Alfalfa meal (dehydrated)	20.0	385	640	2.5	22.0	1.70	0.30
Alfalfa meal (dehydrated)	17.8	261	555	2.8	24.2	1.40	0.20
Animal fats (stabilized)							
Tallow	......	2,900	3,210	100.0	......	......	......
Mixed fats	......	2,760	3,600	100.0	......	......	......
Barley	12.7	811	1,205	1.9	5.4	0.20	0.40
Blood meal	80.0	1,010	1,300	1.0	1.0	0.28	0.28
Bone meal (steamed)	8.6	202	284	4.0	2.5	26.00	13.00
Brewer's dried grains	24.0	1,000	1,150	6.0	16.0	0.20	0.45
Brewer's dried yeast	45.0	570	840	1.0	2.7	0.10	1.40
Calcite	......	......	......	......	......	38.00	......
Calcium carbonate	......	......	......	......	......	38.00	......
Corn (yellow)	8.5	1,145	1,500	3.9	2.0	0.02	0.30
Corn gluten meal	42.9	839	1,475	2.0	3.9	0.20	0.40
Corn gluten meal	61.0	1,160	1,690	3.0	2.5	0.01	0.40
Corn fermentation solubles	23.0	500	700	0.3	......	0.04	1.50
Curacao phosphate	......	......	......	......	......	34.00	14.00
Defluorinated phosphate	......	......	......	......	......	32.00	18.00
Dicalcium phosphate	......	......	......	......	......	24.00	18.50
Distiller's dried grains with solubles	27.0	890	1,050	7.0	9.0	0.12	0.68
Distiller's dried solubles	28.0	853	1,250	6.7	3.3	0.40	1.40
Feather meal	83.0	600	1,010	2.5	1.5	0.20	0.75
Fishmeal (herring)	70.0	930	1,350	7.0	1.0	3.00	2.00
Fishmeal (menhaden)	62.2	900	1,234	8.5	0.7	5.00	3.40
Fish solubles (carrier dried)	54.0	732	1,125	2.5	3.5	0.25	1.00
Fish solubles (50% solids)	30.0	450	615	3.0	......	0.10	0.80
Limestone (ground)	......	......	......	......	......	38.00	......
Meat meal	55.0	760	920	6.0	2.5	8.00	4.00
Meat and bone meal	50.6	724	871	10.0	2.0	9.70	4.20
Milo	9.0	1,100	1,480	2.5	2.7	0.02	0.30
Oats (ground)	12.0	817	1,165	4.6	11.0	0.10	0.40
Oat hulls	2.0	0.0	140	0.5	36.5	0.09	0.10
Oyster shells	......	......	......	......	......	38.00	......
Poultry byproducts meal	58.0	900	1,280	12.0	2.5	3.00	1.70
Soybean meal (solvent)	45.0	565	1,020	1.0	5.9	0.30	0.60
Soybean meal (solvent, dehulled)	51.0	630	1,120	1.0	3.0	0.30	0.60
Vegetable oil	......	2,900	4,000	100.0	......	......	......
Wheat bran	16.4	478	510	4.3	9.9	0.10	1.30
Wheat (ground)	10.0	920	1,405	1.5	2.8	0.05	0.30
Wheat standard middlings	17.6	513	885	5.0	6.7	0.10	0.80
Whey (dried)	12.2	490	868	0.8	0.2	0.90	0.80
Whey (partially delactosed)	17.2	490	868	1.0	......	1.50	1.00

Table 10. (continued)

Ingredient	Vitamins					Amino acids					
	Choline	Riboflavin	Pantothenic acid	Niacin	Vitamin A	Arginine	Lysine	Methionine	Cystine	Tryptophan	Glycine
	mg./lb				I.U./lb	percent					
Alfalfa meal (dehydrated, 20% protein)	500	7.0	18.0	16.0	150,000	0.96	1.00	0.32	0.44	0.36	1.10
Alfalfa meal (dehydrated, 17.8% protein)	400	7.3	12.3	8.7	100,000	0.82	0.95	0.30	0.33	0.29	0.88
Animal fats (stabilized)											
Tallow	......	......	......	......	......	......	......	......	......	......	......
Mixed fats	......	......	......	......	......	......	......	......	......	......	......
Barley	500	0.8	3.7	24.1	......	0.58	0.36	0.17	0.22	0.14	0.40
Blood meal	300	0.7	0.5	14.0	......	3.40	6.30	1.00	1.40	1.10	4.50
Bone meal (steamed)	......	......	......	......	......	1.70	0.90	0.20	0.10	0.05	......
Brewer's dried grains	640	0.3	3.9	18.0	......	1.20	0.90	0.40	0.47	0.30	1.00
Brewer's dried yeast	1,750	15.0	50.0	200.0	......	2.18	3.22	0.79	0.50	0.64	2.02
Calcite	......	......	......	......	......	......	......	......	......	......	......
Calcium carbonate	......	......	......	......	......	......	......	......	......	......	......
Corn (yellow)	200	0.5	2.6	9.8	1,000	0.43	0.27	0.16	0.15	0.08	0.32
Corn gluten meal (42.9% protein)	136	0.7	3.8	24.8	10,000	1.32	0.75	1.00	0.68	0.23	1.69
Corn gluten meal (61.0% protein)	150	0.7	1.3	25.0	20,000	2.20	1.40	1.60	0.90	0.30	2.50
Corn fermentation solubles	320	2.3	6.8	37.0	......	1.00	1.00	0.54	0.30	0.10	0.90
Curacao phosphate	......	......	......	......	......	......	......	......	......	......	......
Defluorinated phosphate	......	......	......	......	......	......	......	......	......	......	......
Dicalcium phosphate	......	......	......	......	......	......	......	......	......	......	......
Distiller's dried grains with solubles	1,200	3.5	5.0	35.0	......	1.00	0.80	0.50	0.30	0.20	0.50
Distiller's dried solubles	2,000	5.2	8.9	54.3	......	0.92	0.94	0.42	0.19	0.18	0.96
Feather meal	400	0.8	3.5	8.0	......	5.10	1.80	0.57	2.80	0.57	5.70
Fishmeal (herring)	1,800	4.0	4.0	40.0	......	5.30	5.70	1.90	0.64	0.85	4.20
Fishmeal (menhaden)	1,400	2.4	4.0	25.9	......	3.96	5.75	1.74	0.87	0.70	3.91
Fish solubles (carrier dried)	2,200	7.0	20.0	85.2	......	3.10	3.06	0.85	0.52	0.54	3.47
Fish solubles (50% solids)	1,400	6.0	18.0	76.7	......	1.50	1.60	0.56	0.21	0.24	2.50
Limestone (ground)	......	......	......	......	......	......	......	......	......	......	......
Meat meal	850	1.6	2.0	23.0	......	3.80	3.80	0.78	0.62	0.35	7.70
Meat and bone meal	900	2.1	1.5	21.4	......	3.34	2.98	0.73	0.61	0.36	5.60
Milo	200	0.4	3.8	18.0	......	0.37	0.29	0.16	0.18	0.11	0.30
Oats (ground)	450	0.4	6.8	8.2	......	0.74	0.47	0.16	0.20	0.15	0.43
Oat hulls	100	0.5	1.3	4.5	......	......	......	......	......	......	......
Oyster shells	......	......	......	......	......	......	......	......	......	......	......
Poultry byproducts meal	2,720	4.0	4.0	18.0	......	3.50	2.70	0.95	1.00	0.42	2.90
Soybean meal (solvent)	1,300	1.4	6.2	17.1	......	3.21	2.93	0.59	0.63	0.61	1.94
Soybean meal (solvent, dehulled)	1,500	1.4	6.2	17.1	......	3.63	3.31	0.67	0.71	0.69	2.19
Vegetable oil	......	......	......	......	......	......	......	......	......	......	......
Wheat bran	600	1.4	13.6	63.5	......	1.01	0.64	0.17	0.22	0.26	0.73
Wheat (ground)	300	0.4	4.5	26.0	......	0.55	0.39	0.18	0.22	0.16	0.69
Wheat standard middlings	540	0.8	9.3	44.3	......	0.98	0.67	0.19	0.19	0.21	0.43
Whey (dried)	800	13.0	22.4	5.1	......	0.31	0.90	0.16	0.33	0.18	0.70
Whey (partially delactosed)	1,900	24.0	34.0	8.0	......	0.59	1.49	0.57	0.57	0.36	1.04

Footnotes

1. The all-mash grower is a complete feed of medium energy. It also may be used with a moderate feed restriction program. If this is desired, limit daily feed intake to approximately 80-85 percent of what is normally consumed. (See table 11. Also see text for formula adjustment.)

2. The layer and breeder rations given are complete and need no supplemental calcium. See feeding instructions for possible modifications.

3. Heavy weight oats should be used in starting and laying rations; light weight oats may be used in growing rations. Also see information on general formulation changes.

4. Poultry byproduct meal or soybean meal may be substituted for the meat and bone meal. Adjustments should be made in the calcium and phosphorus levels as needed.

5. Formulas are based on a condensed fish soluble product that has been dried on soybean meal at 100 percent equivalence. Other products may be used, but fish soluble equivalence should be maintained.

6. Dicalcium phosphate may be replaced with steamed bone meal or defluorinated phosphates, providing calcium and phosphorus levels are maintained.

7. Care should be used to avoid high magnesium limestones. Rations are based on limestones containing 38 percent calcium.

8. Other accepted sources of zinc or manganese may be used if equivalent amounts of zinc and manganese are maintained. A poultry trace mineralized salt may serve as a substitute also. If the latter contains iodine, the iodized salt may be replaced with plain salt.

9. These rations rely on natural ingredients to furnish part of the vitamin requirements. Since there is some loss of provitamin A in corn and alfalfa during storage, the added vitamin A level should be increased by 2-3 million units per ton when using stored ingredients. Commercial vitamin premixes providing the minimum levels listed are available. Table 9 gives vitamin premixes for the complete formulas. Care should be exercised in premixing and mixing vitamins to ensure a thorough distribution of vitamins throughout the feed. Vitamin concentrates should be stored in a cool dry place to reduce potency loss.

10. The use and choice of feed additives vary markedly with individual practices and considerations. The +, –, and ± notations indicate whether additives mentioned in the formula charts are, respectively, generally used, not used, or are optional for the rations described. The use of additives may be summarized as follows: Coccidiostats should be added to starting rations and to growing rations as needed. Low-level antibiotic supplementation is practiced in broiler and starting rations; it is optional in other rations. Follow levels suggested by manufacturer. Antioxidants can be added to reduce vitamin potency loss. They also can be used in laying or broiler rations to increase yolk or skin pigmentation, respectively.

11. Adjustment in corn level can be made to produce an even 2,000 pounds.

12. Plant phosphorus calculated to be 30 percent inorganic.

13. See feeding instructions for proper use of supplements, concentrates, and superconcentrates.

14. Grades of animal fat suitable for feeding include: "bleachable fancy," "prime," and "special" tallows and "A white," "B white," and "yellow" greases. The fat must have a guaranteed stability of at least 20 hours (A.O.M. test). Various vegetable oils may be used also.

15. The mixtures listed provide the minimum levels required per ton in the complete rations. In constructing these mixtures, extreme care must be used in weighing and mixing—equally important are storage and final mixing. Unless facilities for accurate weighing are available and extreme care is exercised, constructing vitamin mixtures is inadvisable.

Table 11. Approximate growth and feed consumption data for pullets*

Age	Light breeds			Heavy breeds		
		Feed consumption			Feed consumption	
	Average weight	Previous 2 weeks	Cumulative	Average weight	Previous 2 weeks	Cumulative
weeks	pounds					
2	0.3	0.6	0.6	0.35	0.6	0.6
4	0.6	0.9	1.5	0.8	0.9	1.5
6	1.0	1.3	2.8	1.4	1.6	3.1
8	1.4	1.4	4.2	2.1	2.3	5.4
10	1.8	1.6	5.8	2.8	2.6	8.0
12	2.1	1.8	7.6	3.5	2.7	10.7
14	2.4	2.0	9.6	4.1	3.0	13.7
16	2.7	2.1	11.7	4.6	3.4	17.1
18	2.9	2.1	13.8	5.0	3.4	20.5
20	3.1	2.2	16.0	5.3	3.5	24.0
22	3.3	2.2	18.2	5.5	3.5	27.5

* To approximate daily water consumption (in gallons) for any age, egg production rate, or body weight of pullets, hens, or broilers, divide the daily feed intake by four. For example, table 12 indicates that 100 Leghorn-type hens in 60 percent production will consume 24 pounds of feed daily. They will also consume approximately 6 (24÷4) gallons of water per day. During periods of high temperature, use the value of three as the divisor to reach a closer approximation.

Table 12. Average feed required per 100 hens of various sizes and production rates*

Eggs per 100 hens per day	Feed for 4 pound hens		Feed for 7 pound hens	
	Per day	Per dozen eggs	Per day	Per dozen eggs
	pounds			
0	15.6	......	22.2	......
10	17.0	20.5	23.6	28.4
20	18.5	11.1	25.0	15.0
30	19.9	8.0	26.5	10.6
40	21.3	6.4	27.9	8.4
50	22.8	5.5	29.3	7.0
60	24.2	4.8	30.8	6.2
70	25.6	4.4	32.2	5.5
80	27.0	4.1	33.6	5.0
90	28.5	3.8	35.0	4.7

Source: University of Illinois Circular 606. *Practical Poultry Feeding.* 1946.

* To approximate daily water consumption (in gallons) for any age, egg production rate, or body weight of pullets, hens, or broilers, divide the daily feed intake by four. For example, table 12 indicates that 100 Leghorn-type hens in 60 percent production will consume 24 pounds of feed daily. They will also consume approximately 6 (24÷4) gallons of water per day. During periods of high temperature, use the value of three as the divisor to reach a closer approximation.

Table 13. Feed and water consumption per 1,000 broilers

Age (weeks)	Average weight per bird (pounds)	Daily water consumed (gallons)	Daily feed consumed (pounds)	Cumulative feed by weeks (pounds)
1	0.23	6	23	160
2	0.47	13	51	520
3	0.82	21	86	1,120
4	1.23	29	117	1,940
5	1.72	36	144	2,950
6	2.29	46	183	4,230
7	2.92	51	206	5,670
8	3.52	58	234	7,310
9	4.13	63	254	9,090

Source: University of New Hampshire Bulletin 478. *Growth and Feed Standards for Broilers.* 1963.

Table 14. Feeding and watering space needs per 100 chickens

Age	Feeder space*	Water space†
weeks	inches	
0-2	100	20
2-10	175	40
10-20	250	60
Layers and breeders	300	80

* A 16-inch hanging feeder provides the equivalent of 100 inches of lineal feeder space for birds over 2 weeks of age. This is due to larger effective diameter, a plentiful feed supply, and fewer peck-order effects.

† During the brooding period, two 1-gallon founts are satisfactory. After the brooding period, one 6-foot automatic watering trough may be provided per 300-400 birds or one automatic cup-type fountain for each 100-150 birds.

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