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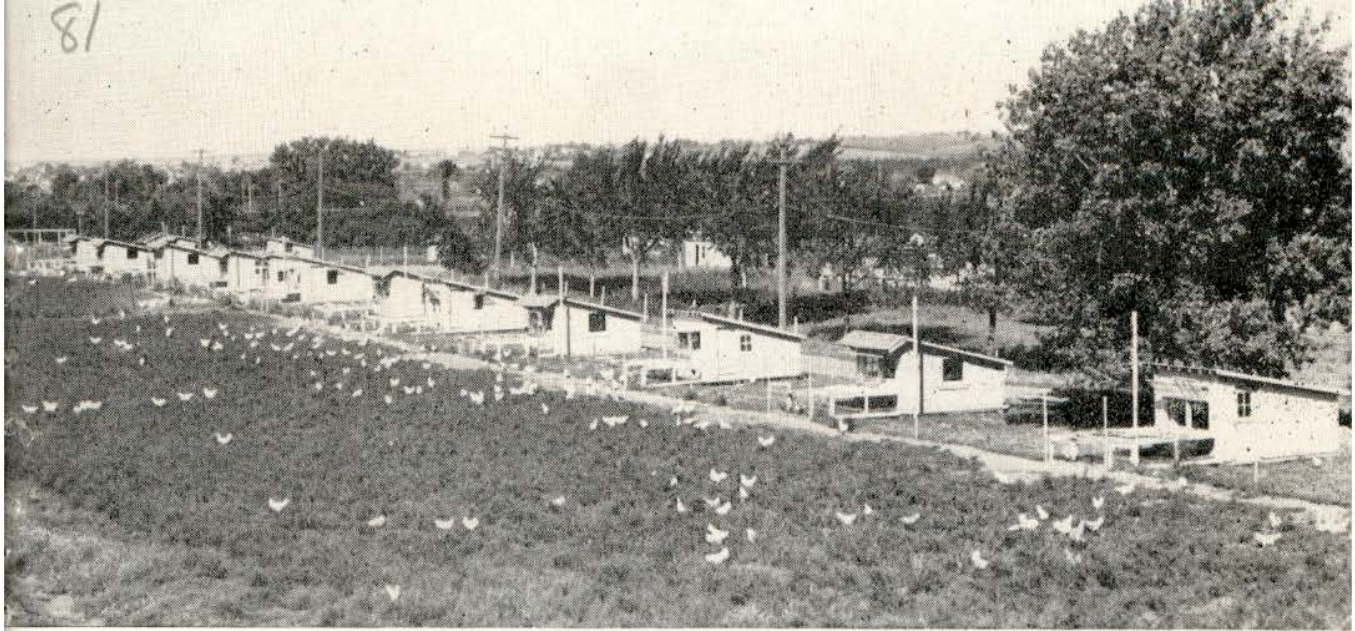
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University of Nebraska College of Agriculture  
Agricultural Experiment Station  
W. W. Burr, Director, Lincoln, Nebraska

## ***Vitamins for Poultry***

*F. E. Mussehl and C. W. Ackerson*

**V**ITAMINS are chemical substances essential for the maintenance of life, growth, and reproduction. Their effects are out of proportion to the relatively small amounts required. *Fortunately, most of these essentials are widely distributed in nature, and an adequate ration can nearly always be provided by using logical combinations of common feedstuffs.* Under certain conditions, however, the use of vitamin-containing concentrates may be desirable. In planning practical rations, it should be recognized that the plant leaf is the source of most vitamins. Milk and meat products make important *vitamin* contributions to the diet in addition to their proteins and minerals. Direct sunshine must also be recognized as the basic source of vitamin D, the rickets-preventing essential.

### **How to Measure Vitamins**

The units of measurement of vitamin values are quantitatively very small.

One pound	=	454	grams
One gram	=	1,000,000	micrograms
One microgram	=	$\frac{1}{454,000,000}$	of a pound



## ***Vitamin Requirements of Poultry***

### **Vitamin A**

UNIT—0.6 microgram of beta carotene is the International Unit (I. U.)

FUNCTION—Promotes growth, prevents xerophthalmia, aids in maintaining normal infection-resisting quality in the mucous membranes, prevents calculi in kidneys and ureters.

PROBABLE REQUIREMENTS (per pound of ration).

Chicks (first 8 weeks)	— 720 micrograms.
Chicks (8 to 24 weeks)	— 1000 micrograms.
Laying and breeding hens	— 2000 micrograms.
Young turkeys	— 1500 micrograms.
Turkey breeders	— 2000 micrograms.

SOURCES—Green pasture, green oats, green wheat, green rye, green blue grass, green clover, alfalfa, alfalfa hay and meal of green color (alfalfa varies from an excellent to a very poor source), carrots, yellow corn, certain fish oils.

STABILITY—Vitamin A is lost from feed ingredients through oxidation. Warm temperatures for long periods promote oxidation. Fresh mixing and cool storage of mixed feed is desirable.



Chick suffering from Xerophthalmia—vitamin A deficiency disease. White corn basal ration. Replacement of white corn with yellow corn made the ration complete and doubled the growth rate.

**Vitamin B<sub>1</sub> (Thiamin)**

UNIT—3 micrograms of U. S. P.—Reference Standard Thiamin Hydrochloride is the U. S. P. unit.

FUNCTION—Improves appetite and digestion, prevents nerve disorder known as polyneuritis. Prevents atrophy of glands.

PROBABLE REQUIREMENTS (per pound of ration).

Chicks — 900 micrograms.

Hens (layers and breeders) — unknown.

Turkeys — unknown.

SOURCES—Wheat, wheat bran, shorts, green feed, dried yeast, fermentation dried solubles, molasses, alfalfa meal, milk, corn.

STABILITY—Thiamin is destroyed by prolonged heating, but is quite resistant to drying.

**B<sub>2</sub> (G) or Riboflavin**

UNIT—microgram.

FUNCTION—Prevents “curled-toe” paralysis in chicks.

Promotes growth, egg production and hatchability.

Prevents “dermatosis” in poults.

Essential for production of normal blood.

PROBABLE REQUIREMENTS (per pound of feed)

Chicks — 1600 micrograms.

Laying hens — 1600 micrograms.

Breeding hens — 2000 micrograms.

Young turkeys — 2000 micrograms.

Breeding turkeys — 2000 micrograms.

SOURCES—Dried liver meal, brewers yeast, dried whey, dried buttermilk, alfalfa meal (made from leafy hay), fish meal, synthetic riboflavin.

STABILITY—Relatively heat stable—more stable in acid medium.

Rather sensitive to light.

Rather resistant to oxidation.

**Niacin**

UNIT—microgram.

FUNCTION—promotes growth and normal condition of all body tissue.

PROBABLE REQUIREMENTS (per pound of feed)

For poultry relatively low. Growing embryo can synthesize niacin.

Not as likely to be lacking as other vitamin factors.

Chicks — 8000 micrograms.

Hens and turkeys — unknown.

SOURCES—Animal products, yeast, wheat bran and shorts, corn gluten feed, peanut meal, alfalfa leaf meal.

STABILITY—Relatively stable.



**Pantothenic Acid** (formerly called the "Filtrate Factor")

UNIT—microgram.

FUNCTION—Promotes growth.

Prevents dermatosis.

Aids feathering and promotes normal pigment deposition.

Essential for healthy nerves.

PROBABLE REQUIREMENTS (per pound of feed)

Chicks — 5000 micrograms.

Laying hens — 7000 micrograms.

SOURCES—Dried liver meal, yeast, dried fermentation solubles, dried whey and buttermilk, alfalfa meal, succulent green feed.

STABILITY—Stable to oxidizing agents and moist heat.

Destroyed by prolonged dry heat.

**Choline**

UNIT—milligram or per cent of total ration.

FUNCTION—Promotes growth.

Essential for maximum egg production and hatchability.

Prevents perosis in chicks and turkeys.

Prevents development of fatty livers.

PROBABLE REQUIREMENTS (per pound of feed)

Chicks — 700 milligrams.

Laying and breeding hens — 500 milligrams.

Poults — 900 milligrams.

Turkey breeders — unknown.

SOURCES—Liver meal, herring meal, fish meal, soybean meal, synthetic choline chloride.

STABILITY—Relatively stable to heat and oxidation.

**Gizzard Erosion Factor**

UNIT—not yet established.

FUNCTION—prevents erosion of gizzard lining.

PROBABLE REQUIREMENTS—satisfied with five per cent good quality non-dehydrated alfalfa meal.

SOURCES—Oats (including hulls), wheat bran, shorts, alfalfa leaf meal, dried pork lung, soybean meal, skim milk.

STABILITY—Gizzard erosion factor is destroyed by heat.

**Vitamin K** (anti-hemorrhagic)

UNIT—milligram (pure K has been synthesized).

FUNCTION—Maintains normal clotting quality of blood.

PROBABLE REQUIREMENTS—Normal clotting quality is provided by two per cent alfalfa meal.

SOURCES—Green grass, alfalfa meal, dried cereal grass.

STABILITY—Relatively stable.

**Vitamin E**

UNIT—one milligram of a standard preparation.

FUNCTION—Promotes fertility and normal embryonic development.

Aids in conservation of vitamin A (as an antioxidant).

PROBABLE REQUIREMENTS—not yet determined.

Most good rations appear to be adequate in vitamin E.

SOURCES—Wheat germ oil, wheat germ meal, wheat shorts, fresh green feed, alfalfa meal, dried liver meal.

STABILITY—Relatively stable except when mixed with rancid feedstuffs.

Fresh grinding and mixing of natural feedstuffs is desirable.

**Biotin**

UNIT—microgram.

FUNCTION—Prevents dermatosis.

Prevents perosis.

Promotes hatchability.

PROBABLE REQUIREMENTS (per pound of ration).

Chicks — 45 micrograms.

Laying and breeding hens — 70 micrograms.

Poults — unknown.

Breeding turkeys — unknown.

SOURCES—Brewers yeast, alfalfa.

STABILITY—Rancid fats in ration destroy biotin.

**Pyridoxin (B<sub>6</sub>)**

UNIT—microgram.

FUNCTION—stimulates appetite, promotes growth.

PROBABLE REQUIREMENTS (per pound of ration).

Chicks — 1800 micrograms.

Breeding flocks — 1800 micrograms.

SOURCES—Cereal grains, grass, alfalfa meal, yeast, meat scraps, milk.

Very widely distributed in natural feeds. Not likely to be deficiency factor.

STABILITY—Relatively stable to heating, destroyed by visible and ultra violet irradiation.

**Vitamin D**

UNIT—For poultry established by Association of Official Agricultural Chemists (A.O.A.C.) based on sample of U. S. P. reference cod liver oil.

FUNCTION—Promotes assimilation and deposition of calcium and phosphorus.

Prevents rickets.

Promotes normal egg shell formation, hatchability.

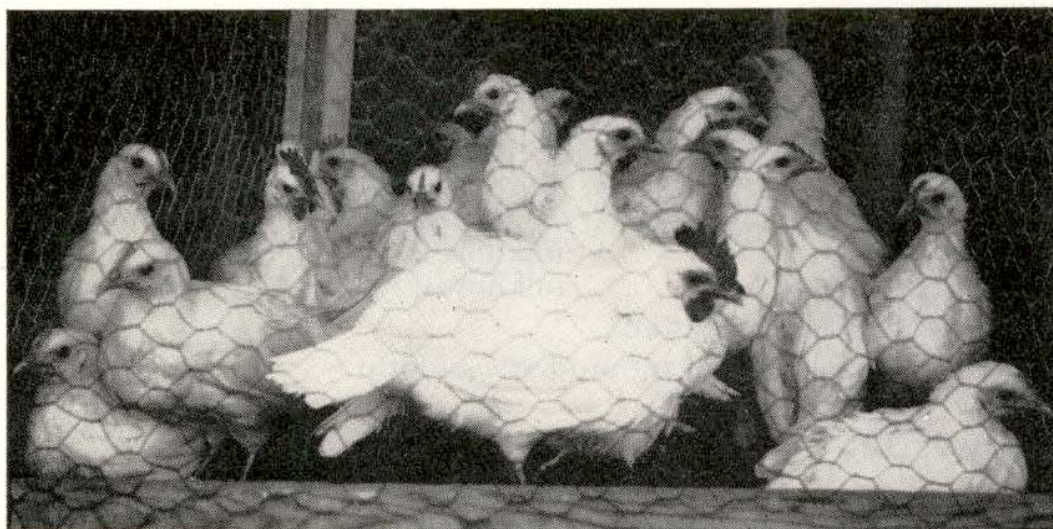


PROBABLE REQUIREMENTS— (per pound of ration) A.O.A.C. units.

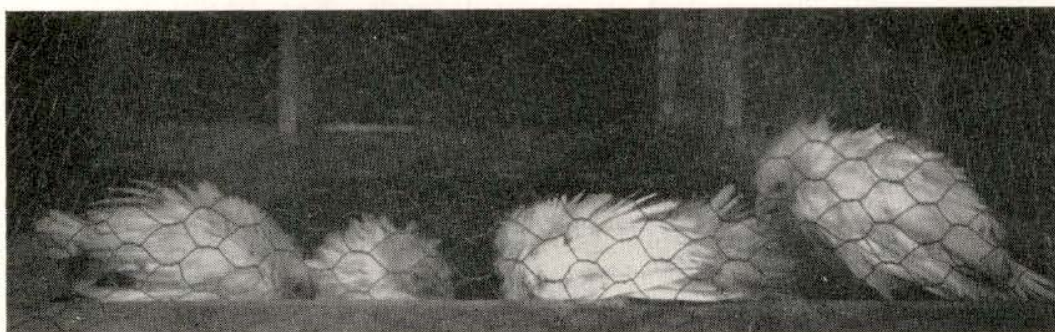
Chicks	— 200 micrograms.
Laying and breeding hens	— 500 micrograms.
Poults	— 400 micrograms.
Turkey breeders	— 600 micrograms.

SOURCES—Direct sunshine, ultra violet energy exposure spectrum 313 to 265 millimicrons (sunshine through common glass not effective). Sunlight lamps, fish oils, activated animal sterols.

STABILITY—Relatively stable, but premixing activated animal sterols with soybean meal is desirable. Fresh blending recommended and storage of carrier at relatively low temperatures.



Thirty-five chicks started in Lot I—35 alive at 56 days of age. Rickets-preventing factor provided by 20 minutes direct sunshine exposure daily when sunshine was available.



Thirty-five chicks started in Lot II—seven survivors at 56 days. All had severe rickets, and were very scrawny in appearance. Same ration as for Lot I, but this lot received sun exposure through window glass only. Window glass does not transmit rickets-preventing ultra violet energy.



### Other Vitamins

In addition to the vitamins listed, several other factors have recently been discovered as involved in poultry nutrition. Quantitative requirements are not yet established. With synthetic or near-synthetic rations, the necessity for *inosital*, *para-aminobenzoic acid*, and *folic acid* can be demonstrated.

### Practical Considerations

Chicks, hens, poults and turkeys require vitamins. Fortunately, most of those which are required are found in natural foodstuffs, or in concentrates which are now available at reasonable costs. With wise use of common protein concentrates, alfalfa meal, green pasture, milk, activated animal sterol, and fermentation by-products, vitamin requirements can be very well satisfied. Full use of direct sunshine, as a source of vitamin D, should also be in the management program.

### Complete Chick and Poults Starting-Mash Formulas

Formulas	48-T for Poults	48-C for Chicks
	<i>Lbs.</i>	<i>Lbs.</i>
1. Yellow cornmeal .....	35.5	24.0
2. Shorts or ground wheat... { or 20% .....	10.0	10.0
3. Bran..... } millrun .....	10.0	10.0
4. Fine pulverized oats or barley.....	10.0	10.0
5. Alfalfa (17% protein minimum plus green color) .....	5.0	5.0
6. Meat scraps .....	5.0	5.0
7. Fish meal (sardine).....	5.0	5.0
8. Soybean meal .....	5.0	10.0
9. Corn gluten meal.....*	5.0	10.0
10. Dried buttermilk .....	3.0	3.0
11. Fermentation dried solubles.....	3.0	3.0
12. *Salt mixture No. 45 .....	3.0	3.0
13. Vitamin D carrier, fish oils or activated ani- mal sterol 100 D per gm. or concentrate equivalent .....	0.5	2.0
	100.0	100.0
Average protein .....	20.7	23.5

\* Salt Mixture No. 45

	<i>Lbs.</i>
Limestone .....	60.00
Iodized salt .....	30.00
Manganese sulphate .....	0.75
	90.75



**Vitamin Concentrate No. 1**  
with specifications for each ingredient

	<i>Lbs.</i>
1. Soybean meal (41% protein).....	446
2. Dehydrated alfalfa meal (protein 17% min. and carotene minimum 150,000 micrograms per lb.).....	300
3. Dried fermentation by-product solubles.....	200
4. Activated animal sterol (2000 A.O.A.C. units vitamin D per gm.).....	50
5. Riboflavin-soybean meal pre-blend (1 oz. synthetic riboflavin plus 4.0 pounds soybean meal).....	4
	1000

**Minimum Vitamin Values**

Vitamin A—30,000 I. U. per pound.

Vitamin D—45,000 A.O.A.C. chick units per pound.

Riboflavin—50,000 micrograms per pound.

This vitamin concentrate also contains appreciable amounts of pantothenic acid, choline, vitamin E, folic acid, niacin and vitamin K.

One-half per cent of Vitamin Concentrate No. 1 added to a typical basal ration should be adequate for chicks, one per cent for chicken layers and breeders, and two per cent for poults and breeding turkeys. More plant leaf material than is included in Vitamin Concentrate No. 1 should be included in the balance of the ration.

