

Feeds and Feeding of Commercial Poultry

AgScience Poultry Science Curriculum
Section 5

Introduction

Nutrition is one of the most important aspects of poultry production

Comprises 60-70% of production cost (CHECK)

Grow more rapidly

Mature at earlier ages

More sensitive to environmental changes

Proper nutrition and productivity are inextricably bound

Optimizing growth

Growth and productivity will be sacrificed without proper nutrition

Deficiencies or Toxicities

Poultry must be provided with the following major nutrient groups:

Proteins

Energy

Minerals

Vitamins

WATER – Most important nutrient! Birds will die very quickly without water.

Nutritional needs of poultry

Feeding behaviors of poultry:

Birds consume many small meals throughout the day

Feed almost always present in the gastrointestinal (G.I) tract

Feed needs to be present at all times!

Eat to meet nutritional needs

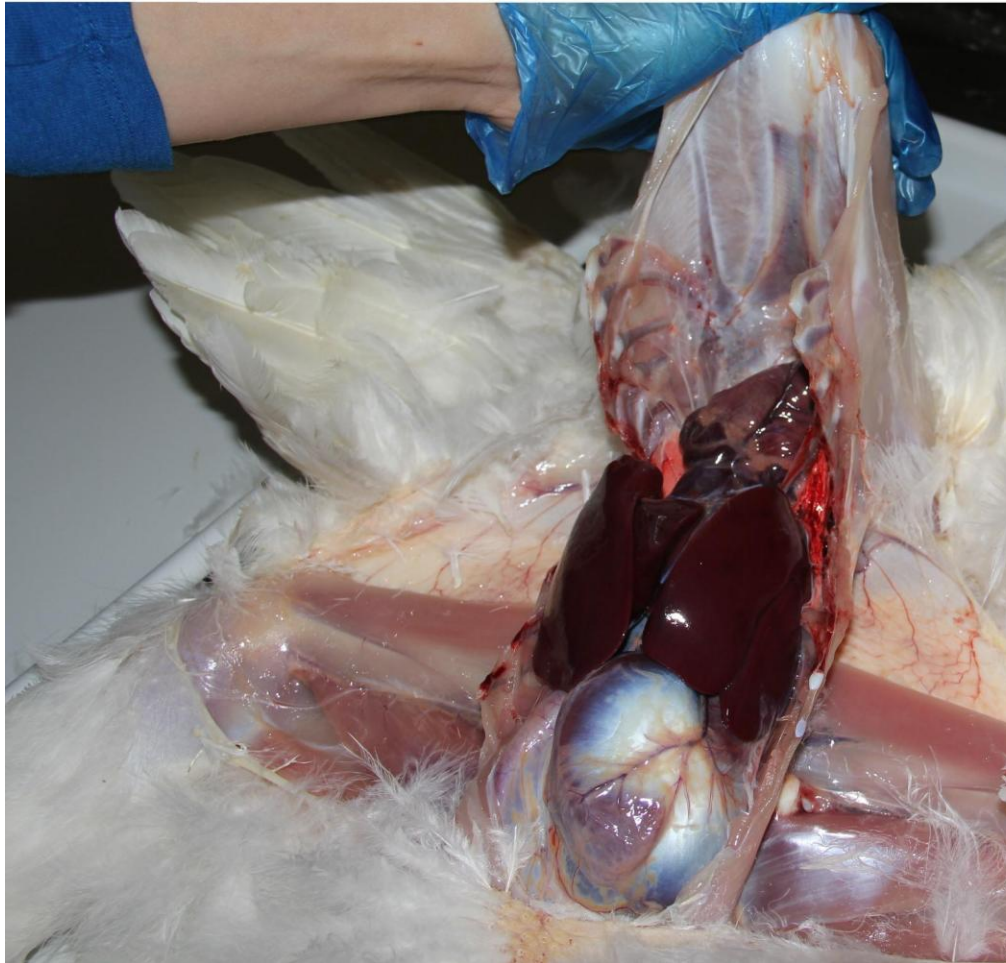
Newly hatched birds can survive on residual yolk

Critical that get on feed as soon as possible

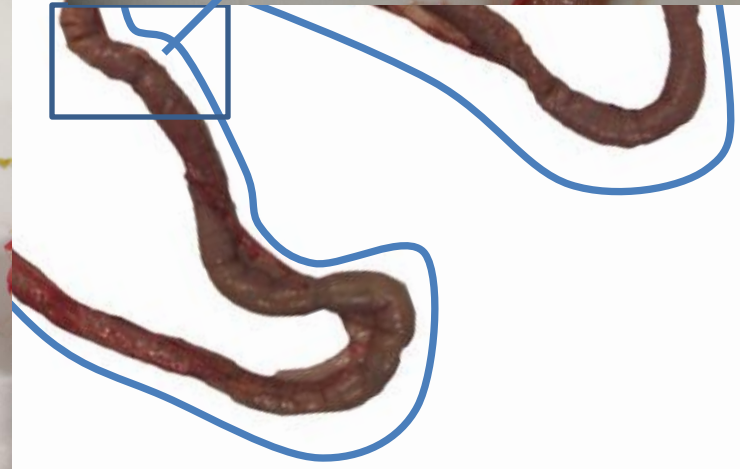
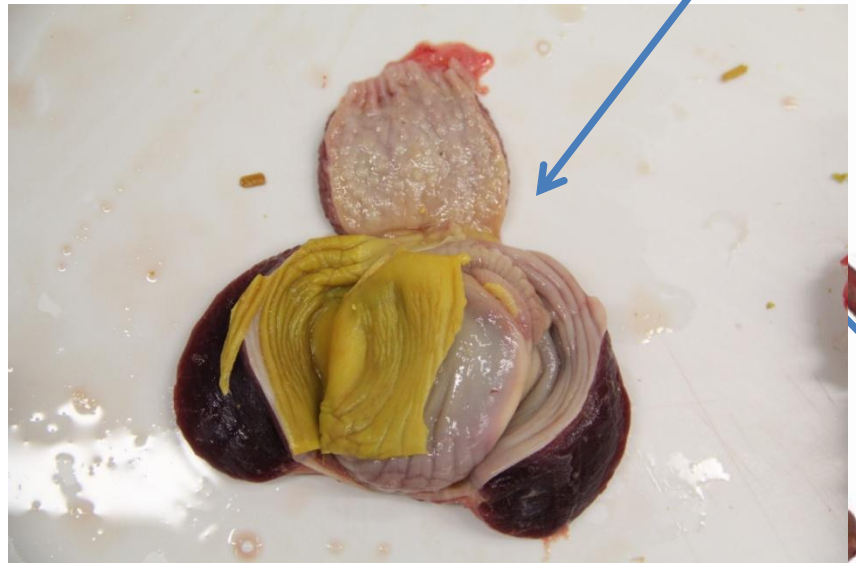
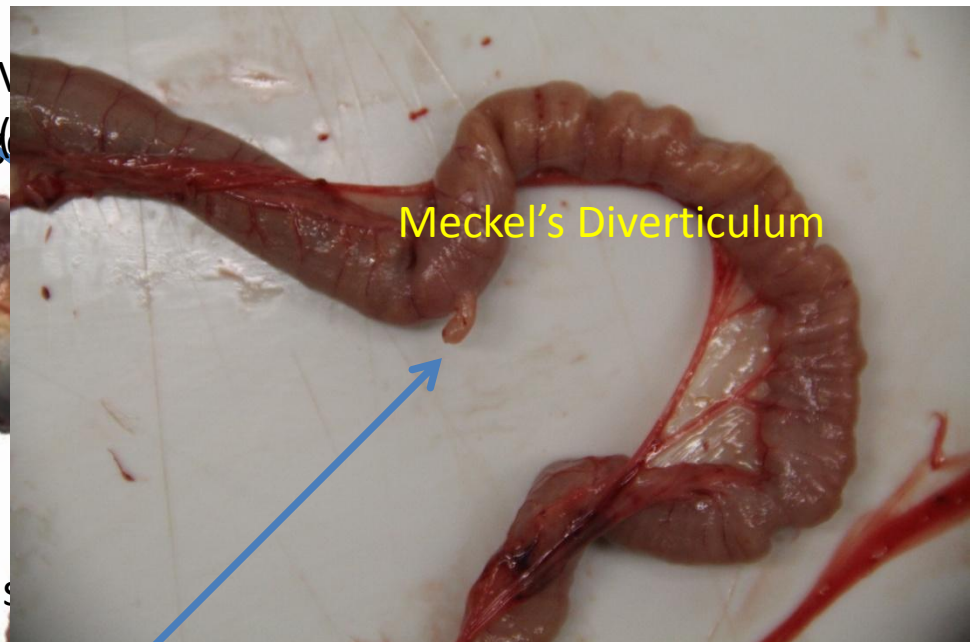
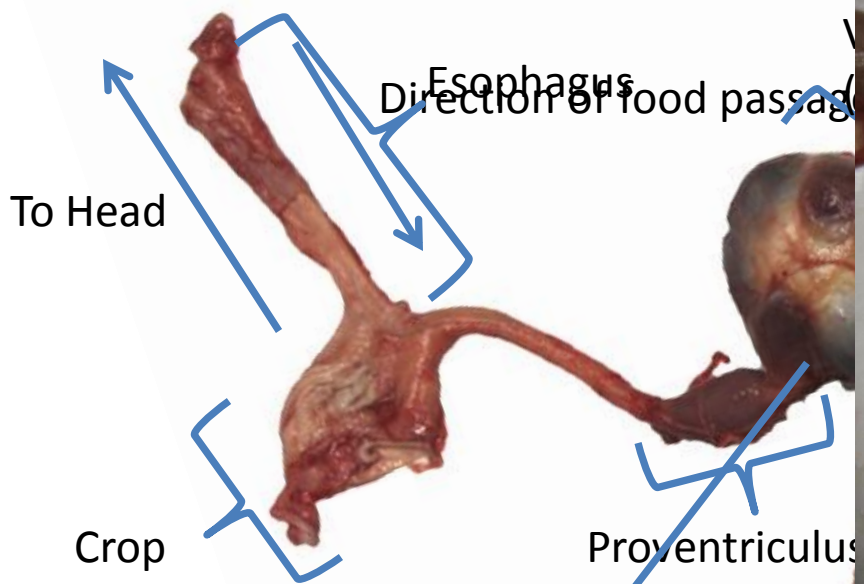
Residual yolk is used to stimulate digestive and absorptive function of G.I. tract

Digestive System

Poultry are **monogastric** – having only one stomach



Digestive System



Nutrient Groups

Dietary Energy

40-50% of feed costs (CHECK)

Derived from carbohydrate sources in the feed

Remember – Birds eat to meet nutritional needs

Low energy diet = high consumption

High energy diet = low consumption

Dietary Energy Sources:

Cereal grains including:

Corn

Milo



Simple Carbohydrates – Majority of energy from these sources

Animal fats

Vegetable oils

Animal by-product meals



Dietary Lipid

Soybeans – although not an ideal source

Nutrient Groups

Dietary Protein

Chains of **Amino acids** – Building blocks of proteins

Essential amino acids – Cannot be metabolized in the body, must be in feedstuffs

Non-essential amino acids – can be metabolized in the body

Used in the body for formation of lean tissue, enzymes, hormones, and body metabolites

Young animals use for building

Old animals use for maintaining

Dietary Sources:

Oilseed byproducts from edible or functional oil production including:

Soybean oil, peanut oil and canola oil

40-60% protein in most cases

Others can be used if available and cost effective

Animal protein by-product meals

Can include feather meal, blood meal, fish meal, meat and bone meal

Product quality is extremely variable

Comprise $\leq 5\%$ of diet

Nutrient Groups

Amino acid requirements are dependent on a variety of factors:

Age

Size of bird

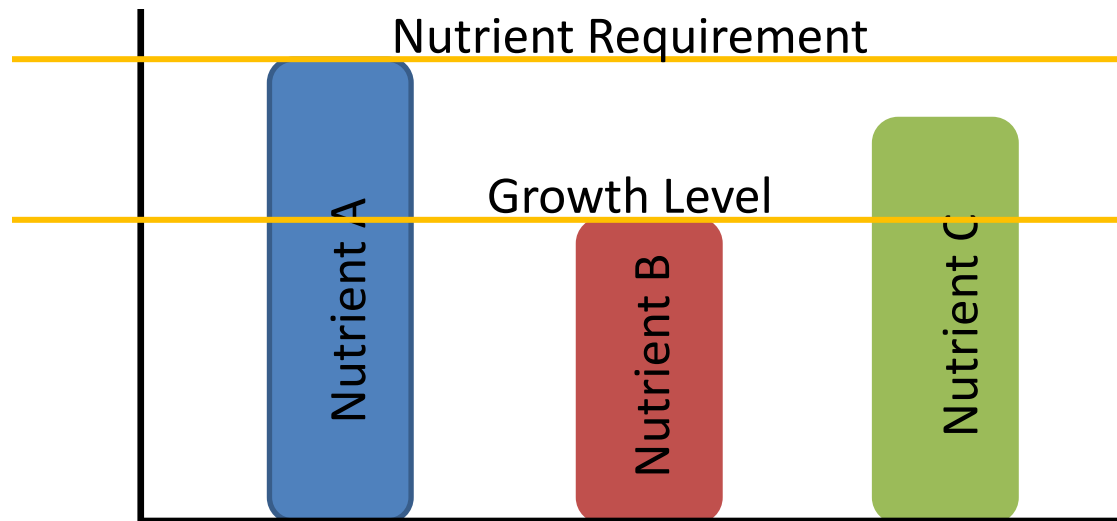
Genetics of bird

Dietary energy level

High energy diets require higher dietary amino acid density.

Limiting amino acid:

Growth will only reach the point of the limiting nutrient in the diet



Common poultry diets are limiting in the amino acid lysine and the sulfur amino acids (methionine and cysteine)

Corn is relatively deficient in lysine

Soy bean meal is relatively deficient in methionine and cysteine

Nutrient Groups

Amino acid digestibility:

Digestibility – amount of amino acid absorbed from the diet that does not end up in excreta

How much of fed amino acid will actually be absorbed by the bird

$$\text{Nutrient digestibility (\%)} = \frac{\text{Nutrient intake} - \text{Nutrient in feces}}{\text{Nutrient intake}} \times 100$$

Amino acid digestibility cont'd:

Ingredient A contains 1.5% lysine with a digestibility of 90%. Ingredient B contains 2.0% lysine with a digestibility of 50%. Which ingredient is contributing more to the dietary lysine?

Nutrient Groups

Dietary Fats:

Triacylglycerides composed of glycerol and 3 fatty acid chains

Source of energy for the body – 2.25 times more than carbohydrates

Source of essential fatty acids

Carriers of fat-soluble vitamins

Dietary Sources:

Tallow

Vegetable oils

Poultry fat

Nutrient Groups

Dietary Vitamins:

Organic compounds needed by the body in very small amounts

Requirements in poultry are relatively high compared to other animals

Few are synthesized in G.I. tract

Fat soluble vs. Water soluble

Fat soluble vitamins:

A – vision, reproduction, bone development

D – Ca absorption

E – Antioxidant, protects cells from oxidative damage

K – Blood clotting

Water soluble vitamins:

ascorbic acid (C), niacin, biotin, choline, etc.

Dietary Sources:

Pre-made vitamin mix

Nutrient Groups

Dietary Minerals:

Inorganic constituents of bones and teeth etc.

Important for enzyme function, immunity and oxygen transport

Macro minerals – Required in relatively large amounts

Ca, P, Na

Micro minerals – Required in relatively small amounts

Zn, Fe, Mn, Cu, Se, I

Dietary Sources:

Salt

Oyster shells

Lime

Bone meal

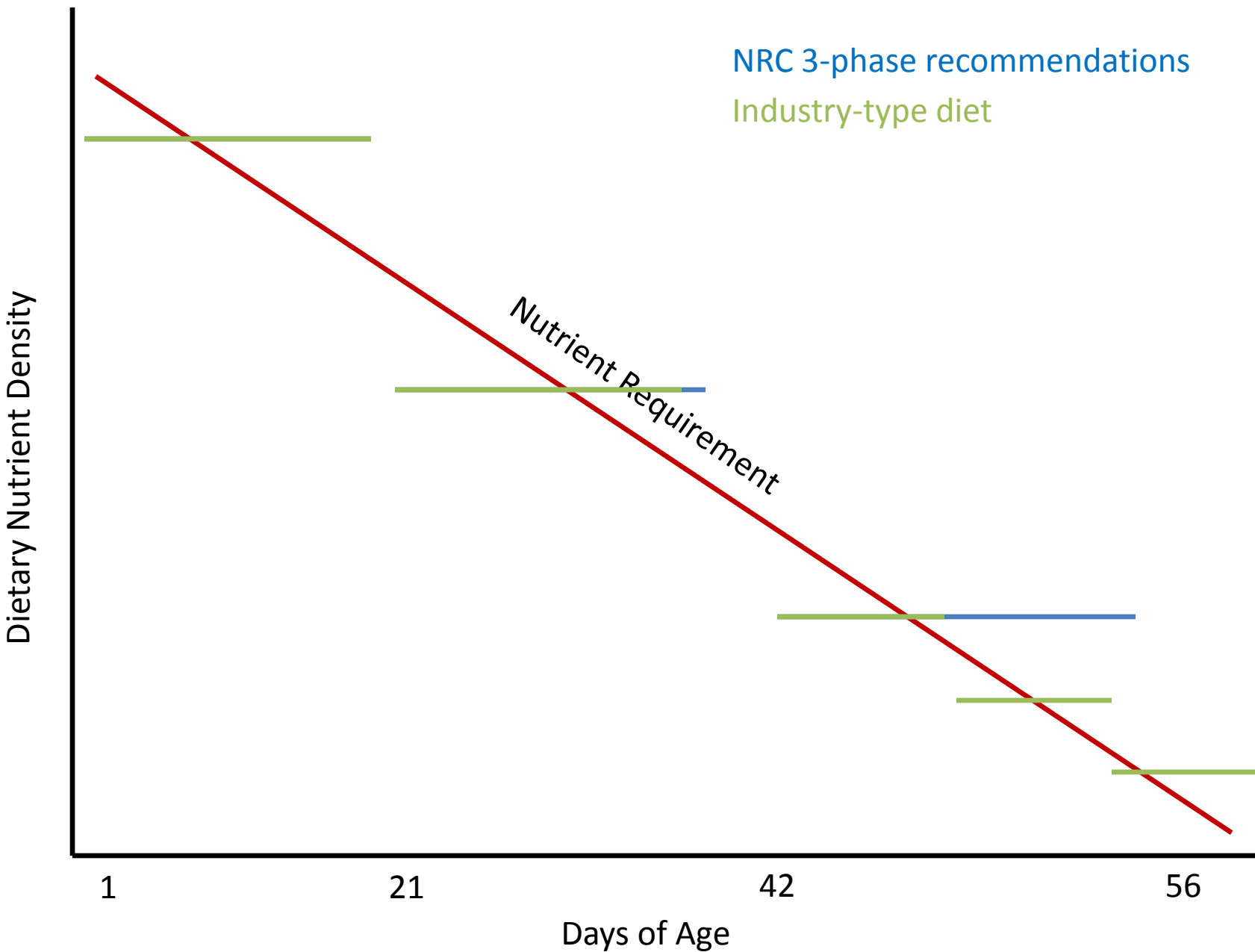
Non-Nutritive feed additives

Coccidiostats – commonly used to protect birds from disease causing organisms that cause coccidiosis a disease that can impair growth and cause increased mortality

Antibiotics – Some antibiotics can have growth promoting abilities because of their ability to improve gut health and nutrient absorption. Strict guidelines are in place to regulate the use of these and overall the use of antibiotics is declining

Hormones – Have never been cleared for use in poultry, therefore commercial poultry is always hormone-free

Diet Formulation



Diet Formulation

Commercial nutritionists often use least-cost formulations for diets

Computer programs are used

Inputs required include:

Nutrients needed and what nutrients are required

List of all available ingredients

Ingredient composition

Amount of energy, amino acids vitamins and minerals

Ingredient cost

Computer will figure the least expensive formulation while still meeting all dietary requirements

Feed Form

Mash

Crumble

Pelleted

	Broiler Starter	Turkey Starter	Chicken Layer
Ingredient	Percentage of Complete Ration		
Yellow Corn	56.46	47.75	60.50
Soybean Meal (48% protein)	27.33	38.83	21.50
Meat and Bone meal (50% protein)	7.0	–	5.09
Meat meal (56% protein)	–	9.50	–
Bakery by-product	6.00	–	–
Animal-vegetable fat	1.82	0.31	3.00
D,L - Methionine	0.17	0.24	0.11
L-Lysine	–	0.23	–
Dicalcium Phosphate	0.13	1.54	0.49
Ground Limestone	0.49	0.81	8.66
Iodized Salt	0.10	0.09	0.20
Sodium Bicarbonate	0.20	0.20	0.20
Vitamin/mineral pre-mix	0.30	0.50	0.25

Diet Formulation

	Broiler Starter	Turkey Starter	Chicken Layer
Analyzed as Fed	Percentage of Complete Ration		
Protein %	22.50	28.00	18.00
Metabolizable Energy (kcal/lb)	1,425	1,280	1,320
Calcium %	0.95	1.45	3.80
Available Phosphorus %	0.48	0.83	0.45
Lysine %	1.21	1.80	0.94
Methionine +Cysteine %	0.92	1.10	0.71

Dietary Deficiencies – Cause and Effect

Fat-soluble Vitamin	Specific Role	Likely Deficiency Symptom
A	Vision, Epithelial cell lining of body	Poor vision in dim light, Increased infections, Weak offspring
D	Aid in Ca absorption	Bone disorders (rickets)
E	Antioxidant, aids selenium	Encephalomalacia ¹ in chicks, white muscle disease
K	Needed for blood clotting	Increased clotting time
B-Complex vitamins	Coenzymes in release of energy, skin health, red-blood cell production	Weakness, dermatitis, poor oxygen transport, anemia, poor growth

¹Observed in chicks and poults less than 2 mo old, Loss of balance and falling backward. Hemorrhage and softness of cerebellum

Malabsorption of fed nutrients as the result of a coccidial infection could cause any of above deficiencies

In formulating poultry diets why is corn and soybean meal a good combination?

Common poultry diets are limiting in the amino acid lysine and the sulfur amino acids (methionine and cysteine)

Corn is relatively deficient in lysine

Soybean meal is relatively deficient in methionine and cysteine. Therefore, when used in combination the deficiencies of these two ingredients are marginalized