INTRODUCTION

This manual has been developed as a study guide for the Florida State Fair Skillathon which is part of the Champion Youth Program. The topic for this year's Skillathon is **nutrition and feeding management**.

The Florida State Fair recognizes that agricultural education instructors, 4-H agents, parents, and leaders provide the traditional and logical instructional link between youth, their livestock projects and current trends in the animal agriculture industry. **PLEASE NOTE:** This manual is provided as a ***study guide*** for the skillathon competition and should be used as an additional aid to ongoing educational programs.

Sections are labeled **Junior, Intermediate & Senior, Intermediate & Senior, or Senior** to help exhibitors and educators identify which materials are required for each age level.

****** Additional information is noted in the study manual for preparing for the Champion of Champions competition.

Juniors (age 8-10 as of September 1, 2026)
Digestive tract parts identification
Feed classification & identification

Intermediates (age 11-13 as of September 1, 2026)
all of the above plus….
Digestive tract functions
Feed tag analysis

Seniors (age 14 and over as of September 1, 2026)
all of the above plus....
Evaluating Feed Efficiency
Evaluating and selecting feedstuffs
Teeth
Toxic plants
Nutrient Functions and Requirements
Processing Feeds
Feed Safety
Common Nutritional Disorders

GOOD LUCK

Rabbit Nutrition

What an animal eats, how those materials are digested, absorbed, and utilized, and what is excreted is the essence of *nutrition*. Good nutrition is basic to good health and production. Proper feeding management requires knowledge of the nutrients in the feedstuffs available to the producer and the nutrient needs of their animals. It also includes an understanding of animal behavior and a management strategy that allows the animals to consume all that is required without causing digestive upset. Though general rules of thumb are helpful, each situation may require adjustments in order to optimize growth and production.

Nutrients are substances in the diet that support normal body functions. Some nutrients can be manufactured in the animal's body and are classified as *dietary non-essential*. *Dietary essential* nutrients must be provided in the ration. Nutrients can be classified into six groups: *water, carbohydrates, fats (lipids), proteins, vitamins and minerals.*

Nutrient	What It Does	Example Source
Water	Helps digestion & temperature control	Drinking water
Carbohydrates	Energy for movement & growth	Corn, wheat
Fats	Extra energy for growth	Vegetable oils
Proteins	Build muscles & feathers	Soybean meal
Vitamins	Support growth & immunity	A, D, E, K, B-complex
Minerals	Strengthen bones & metabolism	Calcium, phosphorus

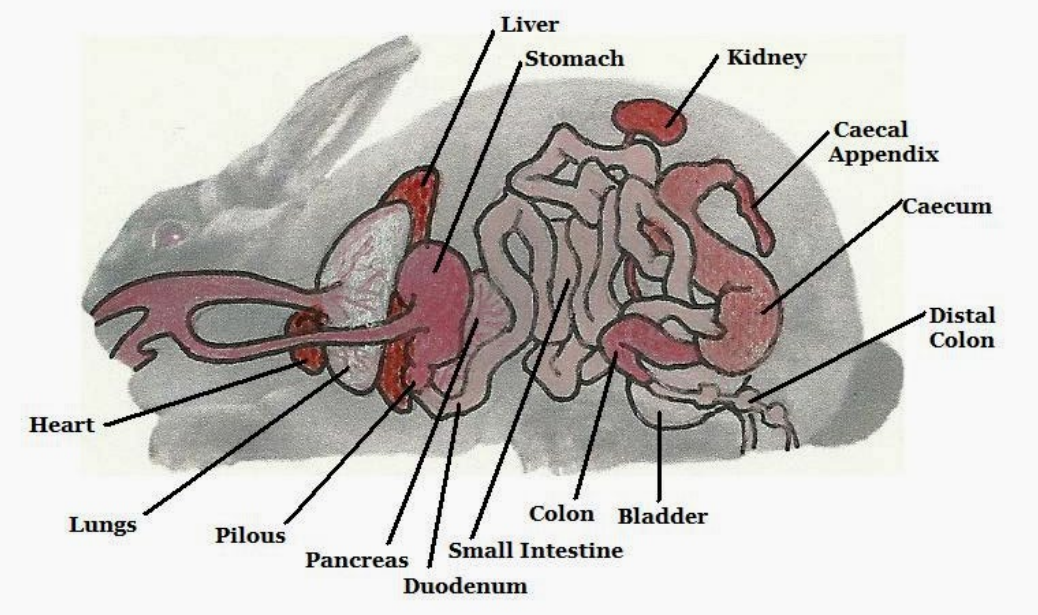
Specific nutrient requirements vary between species but also between individuals. Factors such as weight, environmental temperature, and level of production must be considered when determining optimum nutrient levels in a ration. Though it is tempting to provide more than enough as insurance, some nutrients cause problems (toxicity) if fed in excess. Also, the feeding of livestock accounts for 45-75% of production costs so overfeeding shrinks profits. Too much of a good thing is not good.

Digestive Anatomy

Juniors, Intermediates and Seniors

The saying ‘you are what you eat’ sounds silly but is somewhat true. Farm animals are grouped by what they eat, which is based on the type of digestive system they possess. *Herbivores* are vegetarians (cattle, sheep, goats, rabbits). *Carnivores* are flesh eaters (dogs, cats). *Omnivores* eat both flesh and plants (pigs, chickens, humans). Based on the digestive system, animals are grouped as *monogastric* or *simple stomach* (pig), *polygastric* or *ruminant* (cattle, sheep, goats), *avian* (chickens), or *pseudo-ruminants* with a functional cecum (rabbits). Understanding the digestive system is fundamental to selecting the proper feeds and feeding system for your animal.

After studying this manual, you should be able to identify the parts of the digestive tract of a rabbit and tell the function of each part.



Feed Classification and Identification

The “stuff” fed to animals in order to meet their nutritional needs are called feeds. The National Research Council (NRC) produces many publications on nutrient requirements of animals and nutrient content of most feedstuffs. Most youth purchase “complete rations”, however, it is helpful to know what may go into those rations.

Though we generally group feeds into roughages (high fiber, >18% crude fiber less digestible) and concentrates (low fiber, <18% crude fiber, more readily digestible). There are 8 international feed classes that are based on content and use.

1. Dry forages and roughages – cut and cured products with >18% CF like hay, straw, corn cobs, shells and hulls, paper, wood by-products and stover.
2. Pasture, range plants and forages fed fresh – all forages not cut or cut and fed fresh.
3. Silages and haylages – plant material preserved through the ensiling process, forages like corn, alfalfa and grass.
4. Energy feeds – products with <20% CP, <18% CF and > 70% TDN, like cereal grains (corn, oats, wheat), mill byproducts, beet and citrus pulp, molasses, animal, marine and vegetable fats, nuts, roots and tubers. Energy content of a feedstuff is expressed as percent total digestible nutrients (TDN) because it is strongly correlated with digestible energy.
5. Protein supplements – products with >20% CP or more; protein from non-ruminant animal origin, oilseed meals like soybean or cotton, legume seeds, milling by-products of grains, brewery and distillery by-products, yeast, non-protein nitrogen.
6. Mineral supplements
7. Vitamin supplements
8. Non-nutritive additives – supplements such as antimicrobials, antifungals, antibiotics, antioxidants, probiotics, buffers, coloring material, flavors, hormones and medicines.

Digestive Function

Intermediates and Seniors

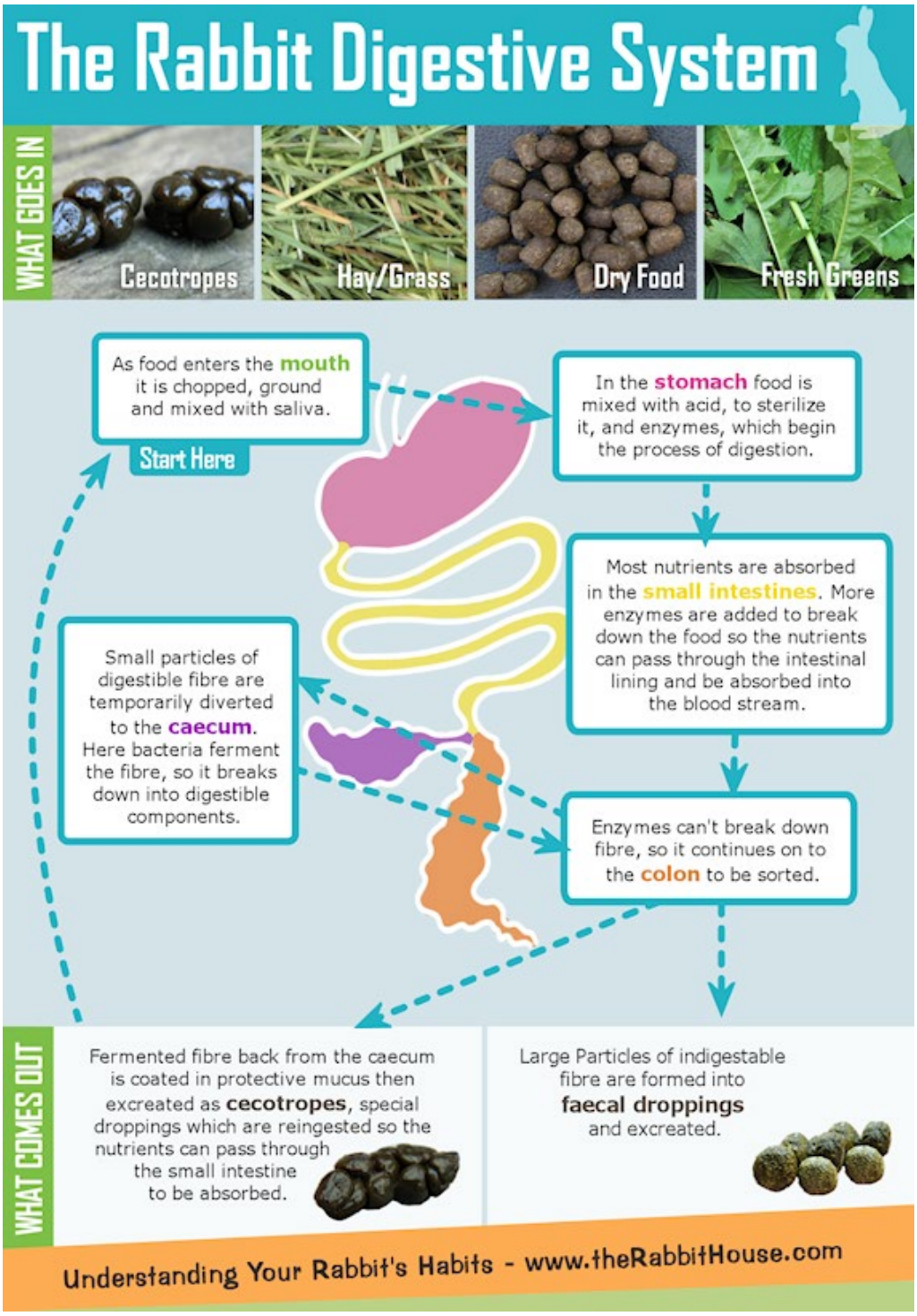
The physical and chemical changes of feed within the gastrointestinal tract that allow nutrients to be released and absorbed into the body are called digestion. There are significant differences in the digestive processes between species. The type of digestive system an animal has determines what the animal can successfully use as feed. Complicated feed (forage) requires a complicated digestive tract (ruminant). The steps in digestion include: prehension (gathering), mastication (chewing), salivation, deglutition (swallowing), microbial, enzymatic and chemical breakdown, absorption of nutrients, defecation, and micturition (urination). For a review of rabbit digestive anatomy and physiology visit: https://herebunny.com/care/feeding/rabbits-digestive-system and https://www.purinamills.com/rabbit-food/education/detail/the-rabbit-digestive-tract. The rabbit digestive system is well adapted for forages and other plant type feeds. The stomach and cecum of the rabbit hold about 80% of the ingested material. Food remains in the rabbit's digestive tract for about 18 hours. The rabbit makes two types of feces: hard pellets and soft. The soft fecal material is eaten by the rabbit allowing the rabbit to benefit from microbial digestion in the cecum. This distinctive trait is called *cecotrophy*.

http://www.therabbithouse.com/diet/rabbit-digestive-system.asp

Rabbit's Digestive System: Parts & Problems

Rabbit Disgestive Tract

Example on how the digestive system works, example below.


The Rabbit Digestive System
WHAT GOES IN
Cecotropes
Hay/Grass
Dry Food
Fresh Greens
As food enters the mouth it is chopped, ground and mixed with saliva.
Start Here
In the stomach food is mixed with acid, to sterilize it, and enzymes, which begin the process of digestion.
Most nutrients are absorbed in the small intestines. More enzymes are added to break down the food so the nutrients can pass through the intestinal lining and be absorbed into the blood stream.
Enzymes can't break down fibre, so it continues on to the colon to be sorted.
Small particles of digestible fibre are temporarily diverted to the caecum. Here bacteria ferment the fibre, so it breaks down into digestible components.
WHAT COMES OUT
Fermented fibre back from the caecum is coated in protective mucus then excreated as cecotropes, special droppings which are reingested so the nutrients can pass through the small intestine to be absorbed.
Large Particles of indigestable fibre are formed into faecal droppings and excreated.
Understanding Your Rabbit's Habits - www.theRabbitHouse.com

Feed Tag Analysis

Intermediates and Seniors

It is required by law that all commercial feed products carry a proper label. You should be able to read and understand the information on a feed tag. Some of the information included will be: net weight in pounds, company brand name (trade name), product name (class or use), product type (textured, pelleted, extruded, etc.) purpose statement, warning or cautions, active drug ingredient (when applicable), guaranteed analysis (protein, fat, fiber, etc.), feed ingredients in order of content, company name and address, detailed use directions, other feeds (suggestions for other feeds in the total program). Go to a feed store and look at the tags on several types of feeds and determine which feeds are best suited to your program and which are the best value in terms of nutrients per dollar. Be prepared to interpret the information on a feed tag.

Guaranteed Analysis:

Crude Protein: not less than __%.
This number represents nitrogen content of feed and does not give a clear picture of protein quality, (e.g. amino acid profile). If all of the protein is not from "natural" ingredients (e.g. contains urea or a similar product) the following statement must be added, "this includes not more than __% equivalent protein from non-protein nitrogen"
Crude Fat: not less than __%, typically 1 to 3%.
At equal volumes fat contributes 2.25 times the amount of energy compared to carbohydrates. Increased crude fat levels can decrease digestion of forages (e.g., hays and grasses). Fat can be added to the diet in hot weather to maintain energy level when intake decreases.
Crude Fiber: not more than __%.
The higher the crude fiber, generally, the lower the digestible energy of the feed. The price should reflect this lesser energy, but frequently does not.
Some manufacturers also show minimum/maximum quantities of calcium and phosphorus and other macro and micro minerals. Units of vitamins A and D may also be shown.

Ingredients: listing on the tag does not necessarily identify individual feedstuffs. Instead, it can list *categories* of feedstuffs, e.g., *grains products* (such as corn, oats, barley, wheat), *processed grain by-products* (bran, brewers grain, hominy), *plant protein products* (soybean meal, cottonseed meal, etc.), *molasses products* (cane or beet molasses, dehydrated molasses, wood molasses), and *forage products* (alfalfa meal or leaf meal). The phrase, *roughage products*, identifies the presence of cottonseed hulls or other types of hulls or ground hays. This total must be shown as a percentage of the feed. Their presence will cause the crude fiber guarantee to be high (16-26% or more) and, as indicated above, lowers the digestible energy content.

The feed tag will also list sources of minerals, any preservatives used, and any vitamin supplements present or used. In the case of a medicated feed, the tag will also include the medication dosage provided and the prescribed use.

Intermediates and Seniors

The fictitious tag below is included to encourage you to think about what information is actually available on the feed tag and to consider what it means to you in your feeding program.

Rabbit Pro Feed

GUARANTEED ANALYSIS

Crude Protein, Minimum	18.0%
Crude Fat, Minimum	3.0%
Crude Fiber, Maximum	19.0%
Calcium (Ca), Minimum	0.7%
Calcium (Ca), Maximum	1.2%
Phosphorus (P), Minimum	0.5%
Salt (NaCl), Minimum	0.6%
Salt (NaCl), Maximum	1.1%
Vitamin A, Minimum	2500 IU/lb

INGREDIENTS

Ground Newspapers, Ground Uncooked Turkey Feathers, Ammonium Nitrate, Super Phosphate, Tincture of Iodine, Used Crankcase Oil, Hardwood Sawdust, Ground Marble Chips, Vitamin A & D Oil, Ground Shoes (without Rubber Soles), Barber Shop Sweepings, Salt.

Manufactured By: LEAST IN THE EAST

Selling Directions: For price conscious feeders who are not interested in results.

Example of a feed tag:

Rabbit Feed Tag
(For Grower and Breeder Rabbits)

Guaranteed Analysis

Crude Protein		Min. 16.0%
Crude Fat		Min. 3.0%
Crude Fiber		Max. 18.5%
Calcium	(Min. 1.1%)	Max. 1.6%
Phosphorous		Min. 0.75%
Salt	(Min. 0.6%)	Max. 1.1%
Vitamin A	Not Less Than	2,800 IU/lb.

Ingredients: Grain Product, Plant Protein Product, Animal Protein Product, Processed Grain By-product, Forage Product, Roughage Product, Animal Fat Preserved with BHA, Yucca Schidigera Extract, Lactic Acid Bacteria, Vitamin A Supplement, Vitamin D Supplement, Vitamin E Supplement, Vitamin B-12 Supplement, Menadione, Sodium Bisulfite, Riboflavin Supplement, Calcium Panthothenate, Niacin Supplement, Folic Acid, Choline Chloride, Biotin, L-Lysine, Calcium Carbonate, Dicalcium Phosphate, Salt, Copper Sulfate, Ferrous Sulfate, Manganous Oxide, Ethylenediamine Dihydriodide, Zinc Oxide, Sodium Selenite, Ethoxyquin (preservative).

Directions For Use: Feed at the rate of 3 to 6 oz./head/day to an adult rabbit. Always provide plenty of fresh, clean water.

How to read a feed tag

Evaluating and Selecting Feeds

Seniors

It is easy to look at the price of a bag of feed and assume that lower cost is the same as higher value. Spend time thinking about your feeding management situation and the types of feeds you have available. Be prepared to judge the relative value of feeds for various scenarios.
There are several methods to assess the value of a feed.

1. Physical evaluation of feedstuff: Does it look good and smell good? Is it free of dust and mold? Is it fresh? Can you see indicators of quality such as high leaf to stem ratio in hays or a high percentage of corn in a finishing ration?

2. Cost per unit of nutrients: This requires some analysis and calculations but it is not difficult.

   Example:

Product	**Soybean Meal**	**Linseed Meal**
Crude Protein	44%	35%
Cost	$22 per 100 Pounds	$17 per 100 pounds

   To solve this problem you must determine the value of each feedstuff for protein:
   - Do this by dividing the cost by the percentage of protein

     Soy bean Meal: $22⁄44= 50 cents per pound of Crude Protein
     Linseed Meal: $17/35= 49 cents per pound of Crude Protein
     Therefore linseed meal is slightly cheaper.

   Another way is to look at productivity. If you must feed your animal twice as many pounds of a low cost, but low protein feed to achieve 100 pounds of gain, it may be more cost effective to pay a higher price and feed less total pounds of feed.

   Example:
   Let's look at the feed stuffs from above but add in rate of gain expected for each feed.

Product	**Soybean Meal**	**Linseed Meal**
Crude Protein	44%	35%
Cost	$22 per 100 Pounds	$17 per 100 pounds
Rate of Gain	1 pound of gain per 2 pounds of feed	1 pound of gain per 3.5 pounds of feed

   Solve for cost per pound of gain.
   - First, determine cost per pound of feed
     Soybean Meal $22/100 pounds = $0.22/pound
     Linseed Meal $17/100pounds = $0.17/pound
   - Next, determine cost per pound of gain
     Soybean Meal: $0.22/pound X 2 pounds feed/pound gain = $0.44/pound of gain
     Linseed Meal: $0.17/pound X 3.5 pounds feed/pound gain = $0.60/pound of gain
   - On a cost of gain basis, soybean meal is cheaper.

3. There are a number of chemical analyses that are carried out on feeds by the companies that produce them. This information is useful in evaluating quality.

4. An often used method of determining quality is to do a home feeding trial. You may do this already without thinking about it. If you run into problems one year, you make adjustments the next year. With limited numbers of animals, this is a slow, often costly process.

Evaluating Feed Efficiency

Seniors

Performance in rabbits is evaluated by calculating average daily gain as well as feed efficiency. Feeding management strategies should strive to optimize growth to reach the desired end point in an appropriate time frame and to reduce feed waste. For example:

A rabbit weighs **1 lb at weaning** and reaches **4.5 lbs market weight** in **50 days**.

- **Weight gained:** 3.5 lbs
- **Average Daily Gain (ADG):**
  - 3.5 lbs ÷ 50 days = **0.07 lbs/day**

If the rabbit consumes **10.5 lbs of feed** during that period:

- **Feed Efficiency:**
  - 10.5 lbs feed ÷ 3.5 lbs gain = **3:1**
  - (3 lbs of feed required for 1 lb of weight gain)

If feed costs **$32.00 per 100 lbs**:

- Feed cost per pound = **$0.32**
- **Cost of Gain:**
  - $0.32 × 3 = **$0.96 per pound of gain**

Result: With a feed efficiency of **3:1** and a feed cost of **$32.00 per 100 lbs**, the rabbit's **cost of gain is $0.96 per pound**.

As you plan your feeding management program, you should develop some performance goals. A complete pellet is the best way to be sure you are meeting both forage and concentrate requirements. Though you want to feed at a high enough level to promote growth and reproduction, you do not want to overfeed. Overweight breeding animals have poor reproductive performance. Lactating does and growing animals should have good quality feed and fresh water available at all times. Other classes of rabbits should have restricted feeding in order to maintain body weight and condition. Practice evaluating feed efficiency in different scenarios so that you can plan an appropriate feeding program for your rabbitry.

Nutrient Functions and Requirements

Seniors

Water is the most essential nutrient and is involved in all body functions. It is the most abundant and therefore the cheapest nutrient. Animals receive water from drinking as well as from feeds that contain water. An animal that is not receiving enough water will not eat well. Factors which affect an animal's water consumption are the animal's size, feed intake environmental temperature, humidity, and water quality.

Proteins function as the basic structural unit of the animal body and in metabolism. Protein is the main component of the organs and soft structures of the animal body with the exception of water. The dietary requirement for protein is highest in young, growing animals. All proteins are composed of simple units called amino acids. The particular amino acids in a protein determine the quality of that protein. Protein is one of the most expensive portions of the diet.

Carbohydrates are organic compounds formed in plants by the process of photosynthesis. They make up about 75% of the dry weight of plants and grain. Carbohydrates serve as a source of energy in the body. A surplus of carbohydrates is transformed into fat and stored.

Fats function much like carbohydrates in that they serve as a source of energy. Fats produce 2 ¼ more energy than carbohydrates when digested; therefore, a smaller amount is required to serve the same function. Some fats are essential for proper metabolism in the animal.

Vitamins are essential for the development of normal tissue and necessary for metabolic activity. They are effective in the animal body in small amounts. When not consumed in an adequate amount a specific **deficiency** disease can result, or **toxicity** may result if eaten in extremely high amounts. Vitamins are classified as being either fat soluble (A, D, E, K) or water soluble (B complex & C). Fat soluble vitamins must be consumed in the diet.

Minerals are inorganic, solid, crystalline chemical elements. They are classified as being either macro (Ca, P, Na, Cl, K, Mg & S) meaning required in high concentrations or micro (Cr, Co, Cu, F, Fe, I, Mn, Mo, Ni, Se, Si, & Zn) meaning required in trace amounts. Calcium makes up nearly 50% of the total body mineral, phosphorus composes 25%, and other minerals make up the remaining 25%. Minerals function in protein synthesis, oxygen transport, and in skeletal formation and maintenance.

Processing Feeds

Seniors

Because feed constitutes a major portion of the cost of intensive animal production, it is very important that a diet have the right nutrient content and be in a form that will encourage consumption without excessive feed waste. Feeds are often processed by mechanical, chemical or thermal methods in order to alter the physical form or particle size to prevent spoilage, isolate certain parts of the seed or plant, to improve palatability and digestibility, or sometimes to inactivate toxins. Occasionally feed is processed to improve handling, like chopped hay. Some methods include: roller mill cracking, grinding, steam-rolled and steam-flaked, pelleting, extruding, popping, drying and cubing. Obviously there are costs associated with processing so the improvements in productivity must offset price increases.

Teeth

Seniors

No matter how good your feeding program, if an animal cannot grasp and chew the feed effectively, production will be compromised. Though managers do not routinely mouth their rabbits, it is a good idea to know if your animals have “sound” mouths, particularly if they are poor performers. Rabbit teeth grow throughout life. With a lot of chewing and gnawing, they should be able to keep them worn down to a usable length. When the upper and lower teeth don’t meet correctly, the result is called malocclusion or “budding teeth”. Nutrition related caused may be calcium and vitamin D deficiency and/or excess calories. Malocclusion can also be genetic. If so, those animals should not be used for breeding. Read about dental problems:

Dental Problems

Feed Safety & Veterinary Feed Directive

Seniors

For decades, antimicrobials and antibiotics have been used in animal feeds at “sub therapeutic” levels to improve growth and feed efficiency. To fight diseases in humans and livestock, antimicrobials are used at therapeutic levels to fight a variety of microorganisms (bacteria, viruses, fungi, parasites) while antibiotics specifically fight bacteria. Microbial resistance is a phenomenon that can develop in humans and animals. The Food and Drug Administration is working with the livestock and feed manufacturing industries to develop strategies to limit the potential for development of resistant microbes. Drugs that are important for treating human disease cannot be used for production purposes. Drugs use to fight animal disease now require veterinary supervision, no more over the counter antimicrobials. Please read about Antibiotics in Livestock & Poultry Production so that you can sort fact from fiction.

What to know, antibiotics in food productioon

Foods and Plants Toxic to Rabbits

Seniors

Rabbits have a relative delicate digestive system that requires high fiber, low sugar and low fat diets. Human foods that should be avoided are: bread, rice, potatoes, chocolate, chips, avocados. Some plants that should be avoided include: anything that grows from a bulb (onions), most fruit seeds, tomato plants, almonds, bracken, nightshade, larkspur, foxglove, poppies, rhubarb, and surprisingly wild carrots, cucumbers, parsnip and peas.

Poisonious Plants

Common Nutritional Disorders**

Disorder	Chief Cause
Coccidiosis	infection of intestines and liver (spores)
Enteritis	inflammation of the intestines
Enterotoxemia	Imbalance between protein and fiber
Diarrhea	Stress, green forage
Cecum stasis	Particle size too small
Lung edema	Feed dust
Pregnancy toxemia	Reduced nutrients to placenta
Trichobezoars (hairballs)	Long hair or low fiber