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)
Digestive tract functions
Feed tag analysis
Aging by teeth

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

GOOD LUCK

Beef Nutrition

What an animal eats, how it is digested, absorbed, 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. *Dietary essential* nutrients must be provided in the **ration**. A ration is the amount of feed an animal receives over a 24-hour period. Some nutrients can be manufactured in the animal's body and these are classified as *dietary non-essential* nutrients. 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

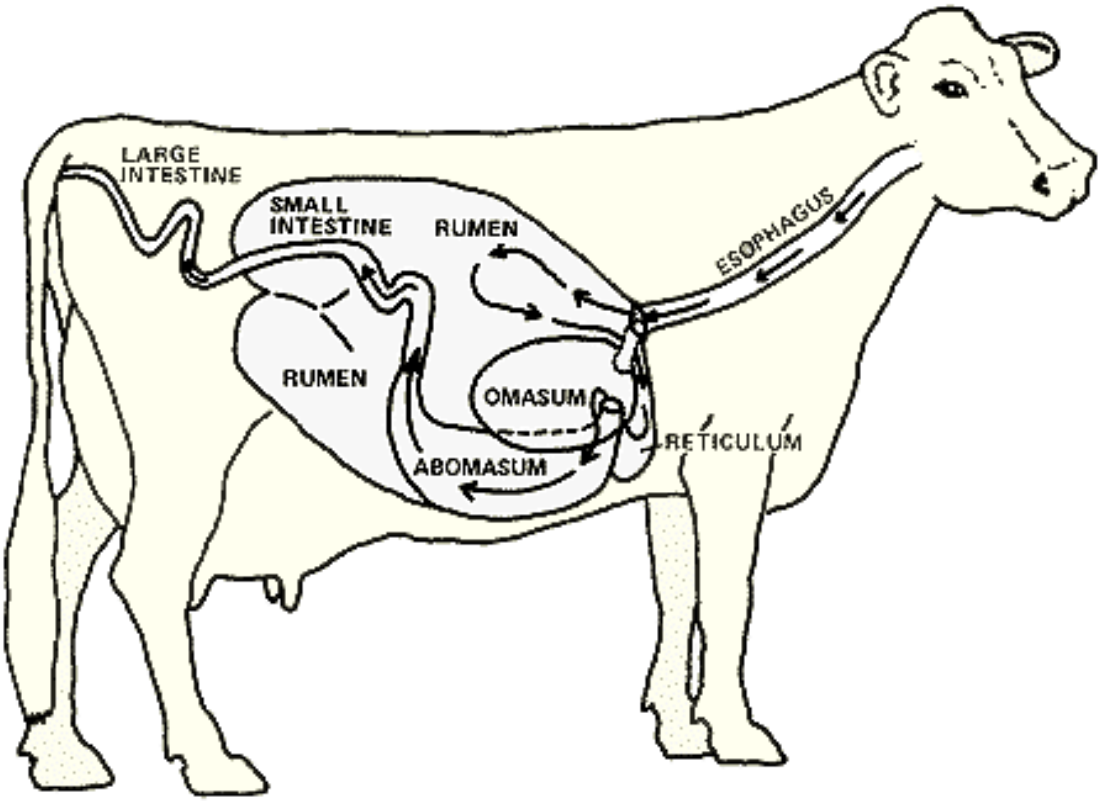
Specific nutrient requirements vary between species but also between individuals. Factors such as weight, environmental temperature, and level of production must be considered when determining optimum nutrient levels in a ration. Though it is tempting to provide more than enough as insurance, some nutrients 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.

Juniors, Intermediates and Seniors

Digestive Anatomy

The old 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, horses). 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 beef animal and tell the function of each part.



Feed Classification and Identification

Rations are formulated to meet the specific needs using minimums, maximums, and guaranteed analysis or potency. Many animals receive a complete feed (mixed or pelleted) but it is useful to understand the specific ingredients that make up the ration or diet

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, barley, 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).

Ruminant Digestive System

Mouth	Upper dental pad, lower incisors and both upper and lower molar teeth, and tongue are used in prehension, mastication, and salivation.	
Esophagus	Hollow muscular tube that transports food from the mouth to the stomach	
Stomach	four compartments: Rumen, Reticulum, Omasum and Abomasum (8-16 gallons)	
Rumen	Large, hollow, muscular compartment that almost entirely fills the left side of the abdomen, functions in storage, soaking, mixing and microbial fermentation, and acts to absorb some specific nutrients (volatile fatty acids, ammonia).(5-10 gallons)	
Reticulum	Nicknamed honeycomb, functions in moving ingested feed into the rumen or into the omasum and regurgitation of partially chewed food during rumination. Has very thick walls, traps foreign objects. (½ gallon)	
Omasum	Nicknamed “many plies” or butcher’s Bible, reduces particle size and removes water. It is located on the right side. (¼ gallon)	
Abomasum	This is the glandular portion of the stomach which produces acid and pepsin. It is located on the right, is called the true stomach and is where enzymatic digestion begins. (½ - 1 gallon)	
Small Intestine	Pancreatic and intestinal juices break down proteins and carbohydrates while bile from the liver breaks down fats. The first section (duodenum) is involved in digestion, and the next two sections (jejunum & ileum) are actively involved in nutrient absorption. (2-2½ gallons and 80 feet)	
Large Intestine	Mainly absorbs water and end products of microbial digestion. The cecum has little function in ruminants. The colon is the site for water resorption and storage reservoir of undigested material which exits the rectum as feces. (½ - 1 gal.)	

Intermediates and Seniors

Feed Tag Analysis

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.

How to read a Cattle 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.

The fictitious tag on the next page 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.

Show Stopper Feed

GUARANTEED ANALYSIS

Crude Protein, Minimum 32.0%
(This includes not more than 11.3% equivalent crude protein from non-protein nitrogen)
Crude Fat, Minimum 2.0%
Crude Fiber, Maximum 7.5%
Calcium (Ca), Minimum 1.3%
Calcium (Ca), Maximum 2.3%
Phosphorus (P), Minimum 0.9%
Iodine (I), Minimum 0.00015%
Salt (NaCl), Minimum 1.0%
Salt (NaCl), Maximum 2.0%

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.

Teeth

Intermediates and Seniors

No matter how good your feeding program is, if a beef animal cannot grasp and chew the feed effectively, production will be compromised. Though cattlemen do not routinely mouth their cattle, it is a good idea to know if your cattle have “sound” mouths, particularly if an animal is a poor performer. A bonus when checking the teeth is that eruption and wearing patterns of teeth can be used to “age” an animal. This useful skill is almost a lost art. **Visit the following web sites, view pictures and learn about teeth from cattle of different ages.**

Sound Teeth

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	$18 per 100 Pounds	$12 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: $18⁄44 = 41 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	$18 per 100 Pounds	$12 per 100 pounds
Rate of Gain	1 pound of gain per 4 pounds of feed	1 pound of gain per 7 pounds of feed

Solve for cost per pound of gain.

- First, determine cost per pound of feed

  Soybean Meal $18/100 pounds = $0.18/pound

  Linseed Meal $12/100pounds = $0.12/pound

- Next, determine cost per pound of gain

  Soybean Meal: $0.18 /pound X 4 pounds feed/pound gain = $0.72/pound of gain

  Linseed Meal: $0.12 /pound X 7 pounds feed/pound gain = $0.84/pound of gain

- On a cost of gain basis, Soybean Meal is slightly cheaper.

3. There are a number of chemical analyses that are performed 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 beef cattle 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.

For example:

Suppose the breeding season begins in **150 days**, and your heifer needs to gain **300 pounds** to reach puberty or an acceptable body condition score.

Step 1: Calculate Average Daily Gain (ADG)

300 pounds needed ÷ 150 days = **2.0 pounds of gain per day**

Step 2: Calculate Feed Efficiency

If the heifer consumes **12 pounds of feed per day** while gaining **2.0 pounds per day**:

12 pounds of feed ÷ 2.0 pounds of gain = **6 pounds of feed per pound of gain (6:1 feed efficiency)**

Step 3: Calculate Cost of Gain

If feed costs **$18.00 per 100 pounds** ($0.18 per pound):

$0.18 × 6 pounds of feed = **$1.08 per pound of gain**

In this example, it costs $1.08 for the heifer to gain each pound of body weight.

Selecting the Right Feed

When developing a feeding program, set performance goals based on the rate of gain needed.

- **Higher rates of gain** require **high-energy feeds** (greater than 70% TDN).
- **Lower or moderate rates of gain** can be achieved with **medium- to low-energy feeds**.

"***High Energy***"
Corn: ~90%
Cracked Wheat: ~88%
Cracked Milo: ~82%
Wheat Middlings: ~79%
Soybean Hulls: ~77%

"***Low Energy***"
Cottonseed Hulls: ~45%
Bermuda Hay: ~47%
Fescue Hay: ~50%
Grazed Forage: ~50-55%

Gains of 1.8 to 2.8 pounds per day are reasonable over the entire feeding program. Practice evaluating feed efficiency for different scenarios so that you can plan an appropriate feeding program for your bull, heifer, or steer.

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 and a veterinary feed directive. More information about using products that require a VFD can be found here. https://bqa.unl.edu/veterinary-feed-directive/
Please read about Antibiotics in Livestock & Poultry Production so that you can sort fact from fiction.
https://extension.okstate.edu/fact-sheets/what-consumers-need-to-know-about-the-use-of-antibiotics-in-food-animal-production

https://www.afia.org/news/afia-blog/setting-the-record-straight-on-antibiotics/

Antibiotics in Food Production

Veterinary Feed Directive

Antibiotics

Seniors

Evaluating Body Condition

Body Condition Scoring

Adjustments in feeding management require knowledge of the individual or herd nutritional status. Changes in body weight can will let you know if your animal is gaining or losing weight but two animals can look very different at the same weight. Changes in body condition or fat deposition can also provide valuable insight relative to nutritional status of an animal. The degree of fatness is evaluated visually and by touch, considering the shoulder, brisket, rib, and rump regions. Below are the descriptions of the 9 body condition scores used in beef production. You should be familiar with this system of evaluation and its applications. For more information and example pictures or each score, visit:
https://vtechworks.lib.vt.edu/bitstream/handle/10919/50710/400-795.pdf .

Body condition scoring system for beef cattle.
Adapted from Wagner et al. 1988. Journal of Animal Science

Score		Description	
Thin	1	Severely emaciated; starving and weak; no palpable fat detectable over back, hips or ribs; tailhead and individual ribs prominently visible; all skeletal structures are visible and sharp to the touch; animals are usually disease stricken. Under normal production systems cattle in this condition score are rare	
	2	Emaciated; similar to BCS 1, but not weakened; little visible muscle tissue; tailhead and ribs less prominent	
	3	Very thin; no fat over ribs or in brisket; backbone easily visible, slight increase in muscling over BCS	

Borderline	4	Borderline; individual ribs noticeable but overall fat cover is lacking; increased musculature through shoulders and hindquarters; hips and backbone slightly rounded versus sharp appearance of BCS 3	
Optimum	5	Moderate; increased fat cover over ribs, generally only 12th and 13th ribs are individually distinguishable; tailhead full, but not rounded.	
	6	Good; back, ribs, and tailhead slightly rounded and spongy when palpated; slight fat deposition in brisket.	
Fat	7	Fat; cow appears fleshy and carries fat over the back, tailhead, and brisket; ribs are not visible; area of vulva and external rectum contain moderate fat deposits; may have slight fat in udder.	
	8	Very fat; squared appearance due to excess fat over back, tailhead, and hindquarters; extreme fat deposition in brisket and throughout ribs; excessive fat around vulva and rectum, and within udder; mobility may begin to be restricted.	
	9	Obese; similar to BCS 8, but to a greater degree; majority of fat deposited in udder limits effective lactation. Under normal production systems cattle in this condition score are rare.	

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. Become familiar with some of the processing methods used in common feedstuff.

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 consuming 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 in the body in fat cells.

Fats function much like carbohydrates in that they serve as a source of energy. Fats produce 2 ¼ times more energy per unit of weight 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. For example, fat soluble vitamins require some fat in the diet for proper absorption and utilization.

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.

Poisonous Plants

Seniors

There are many plants which are harmful to cattle. Most of the time cattle will not eat them but in drought situations, they may. Some examples are: Azaleas, Bracken fern, Cherry, Persimmon, Coffee Senna, Castor Bean, Elderberry, Red Maple, Pigweed, Hemlock, Pokeweed, Locoweed, Leupine, Milk weed, Crotolaria, Lantana, Oleander, Poison Sumac, Rhododendron, Perilla mint, Poinsettia, Stinging Nettle, and Nightshade. With regards to poisonous plants, there are a couple of things to keep in mind:

1. The plant species determines the poisonous substance that causes the problem. A number of things affect the severity of poisoning which include the specific part of the plant, environmental conditions, plant age, and the form the plant is consumed.

2. Some of the common symptoms of poisonous plant consumption include: diarrhea, vomiting, dilated pupils, altered pulse rate (slow or fast), labored breathing, coffee-colored urine, uncoordinated, bleeding, skin ulcers, muscle spasms, paralysis, and death.

Visit the following web sites to learn about the poisonous plants in the southeast.

https://www.youtube.com/watch?v=7c2diignyQk

http://www.ansci.cornell.edu/plants/anispecies.html

Feed Processing Methods

Common Poisonous Plants in Florida

Common Nutritional Disorders**

Disorder	Chief Cause
Hardware disease	Wire or nails lodged in reticulum
Ketosis	Sudden need for extra energy
Acidosis	Excess grain consumption
Grass tetany	Mg deficiency
Night blindness	Vitamin A deficiency
Goiter	Iodine deficiency
Rickets	Ca, P, or vitamin D deficiency (young animals)
Anemia	Fe, Cu, vitamin B12, or folic acid deficiency
Liver abscesses	Bacteria in the gut that grows quickly when cattle are on low roughage/high concentrate finishing rations
Founder (laminitis)	Too rapid change in the ration.
Photosensitization	Some feeds or forages or accumulation of metabolites
Bloat	Legume, succulent forages causing slime producing bacteria to increase and slime causes trapping of gas.
Calf scours	Severe diarrhea
Polioencephalomalacia	Associated with inadequate thiamine status or high sulfur intake