Feedstuffs vary from roughages, such as hay and silage, to concentrates, such as corn and soybeans. Feedstuffs are often enhanced by additives to improve performance of the animal and control animal diseases and other conditions. Processing methods can improve taste and digestion. Animal and plant byproducts can also be used in animal rations. Each ration is formulated specially for a particular group of animals.

Objective:

☑ Compare and contrast the types of feedstuffs for animals.

Key Terms:

- anthelmintics
- antibiotics
- chemoantibacterial
- feed concentrate
- feedstuff
- hormones
- legume
- palatability
- rendering
- roughage
- ruminant
- subtherapeutic
- tankage

Animal Feed

ROUGHAGES

A roughage is a type of feedstuff that contains more than 18 percent crude fiber when dry. A feedstuff is an ingredient used in animal feed. Fiber is an important part of the diets of all animals, including humans. Diets high in fiber are generally better for ruminant animals than for non-ruminant animals. A ruminant is an animal that has a divided stomach with microorganisms that break down tough feed into nutrients the animal can use. There are many
roughages used for animal feed that vary greatly in palatability, digestibility, and nutrient content. Roughages can be preserved in the form of hay or silage. There are two types of roughages used in animal feeds—legumes and nonlegumes.

**Legume Roughages**

A **legume** is a plant that can “fix” nitrogen from the air so that it can be used by the plant. Legumes contain more protein than nonlegumes. Roughages from legumes consist of the leaves, stems, and stalks of the plant. The seeds of a roughage would be considered a concentrate. Examples of legumes are clover, alfalfa, soybeans, trefoil, lespedeza, peas, and beans.

**Nonlegume Roughages**

Nonlegume roughages cannot use nitrogen from the air and are lower in protein. Examples of nonlegume roughages include corn silage, sorghum silage, fodder, bluegrass, timothy, redtop, bromegrass, orchard grass, fescue, bermudagrass, and prairie grasses.

**CONCENTRATES**

A **feed concentrate** is a type of feedstuff that contains less than 18 percent crude fiber when dry. Concentrates are mostly used in non-ruminant animal rations. However, ruminant animals are also fed concentrates, but their rations must include large amounts of roughages for good health. Also, roughages are less expensive than concentrates, and it is much more economical to feed ruminants roughages rather than concentrates. There are two types of concentrates—protein supplements and energy feeds.

**Protein Supplements**

Protein supplements contain 20 percent or more protein. They are further classified as either animal or vegetable proteins. Animal proteins, such as tankage and blood meal, contain a
more balanced array of the amino acids that make up proteins. Soybean meal is the most palatable of the protein supplements and one of the most economical. It is used widely in animal rations. Other protein supplements include bone meal, dried milk, cottonseed meal, peanut meal, and dried distiller’s grains.

**Energy Feeds**

Energy feeds contain less than 20 percent crude protein. Most grains are considered energy feeds. Corn is the most widely used energy feed. Other energy feeds include wheat, oats, dried whey, barley, and rye. Adequate amounts of protein supplements must be added to energy feeds to meet the protein and energy needs of animals.

**ADDITIVES**

Feed additives are used in the animal industry to improve performance and to prevent and control diseases and parasites. All additives must be approved by regulatory agencies, such as the Food and Drug Administration (FDA) and the United States Department of Agriculture (USDA). These agency approvals must be shown on feed product labels. If medicated feeds are used, a withdrawal period is required before sending animals to slaughter. Concerns have been raised about the possibility of the formation of antibiotic-resistant diseases because of the frequent use of medication in animal feeds.

**Antimicrobial Drugs**

Antimicrobial drugs are sometimes used at a subtherapeutic level in animal feed. To administer a drug at a subtherapeutic level means regularly adding the drug to feed at a dosage below the level used to treat the disease if it is diagnosed in the animal. Drugs administered at the subtherapeutic level are sometimes added to feed to prevent the target disease from occurring. There are two kinds of antimicrobials—antibiotics and chemoantibacterials. Living organisms produce antibiotics. Chemoantibacterial compounds are produced from chemicals. Collectively, these compounds are referred to as antibiotics.

**Hormones and Hormone-Like Compounds**

Naturally occurring hormones are secreted into body fluids by various glands in the body. These hormones regulate body functions, such as growth and metabolism. Hormone-like compounds are synthetic reproductions of natural hormones and are added to animal feeds to improve feed efficiency and growth rate. They can also be used to suppress estrus. Hormone-like compounds are most widely used in the beef cattle industry.
**Anthelmintics**

Worms reduce feed efficiency and rate of gain in infested animals. Compounds used to control various species of parasitic worms are called **anthelmintics**. Anthelmintics can be administered to the animal through feed or water. If one animal in a group has a worm problem, the entire group should be treated with an anthelmintic.

**Other Additives**

Coccidiostats can be added to poultry rations to prevent the disease coccidiosis, which causes a decrease in performance and diarrhea. Materials, such as limestone and sodium bicarbonate, can be added to feed to regulate pH level and improve digestion. Additives are also available that prevent bloat and control flies. Flavoring is sometimes added to feeds to increase palatability. Vitamins and minerals are also sometimes added to feed ingredients. They are covered in other related E-units.

**PROCESSING FEEDSTUFFS**

Most feedstuffs can be fed to animals in their natural state. However, processing to some degree is generally beneficial. Feeds are processed for many reasons, including palatability, digestibility, convenience, and ease of feeding and handling. **Palatability** refers to how a feed tastes to the animal. The more processing a feed goes through, the more it costs. Many producers mix and process their own feed to avoid the high cost of commercially prepared feeds. Animals usually prefer some level of food being cracked and crushed to whole kernels and grains, but the feed must not be too finely ground. Finely ground, dusty feed may limit feed intake and is not good for digestive system health. There are many ways to process feed.

**Grinding**

Dry feedstuffs can be processed by grinding in a hammer mill. Rotating hammers beat the feed until the particles are small enough to filter through a screen. Screens with different diameter holes can be interchanged to obtain varying degrees of coarse and fine products.

**High-Moisture Storage**

High-moisture storage involves harvesting feed at a high-moisture content and storing it in a silo or in other suitable fermentation storage. Silage is made from crops, such as corn and sorghum, using the entire plant. It is fermented in a process called ensilage. Silos give off poisonous gases, so great care should be used when handling feed in a silo.

*FIGURE 4. A large amount of feed is able to be stored at this farm through the use of silos.*
**Rolling and Crimping**

Rolled grain is processed by rolling the grain through a set of smooth rollers. The rollers press the grain into flakes, thus the process is sometimes called flaking. The crimping process uses corrugated rollers.

**Pelleting and Cubing**

Pelleted feeds are produced by grinding grain and other feedstuffs into small particles and forming them into pellets or cubes. Cubes are larger in size than pellets. Range cubes are a common cattle feed supplement. Most animals can more easily digest feed if it is in pelleted form, resulting in an increase in feed efficiency. Also, less feed is wasted by feeding pellets when compared to ground feeds. Pelleted feeds are convenient to handle and feed. Feed manufacturers most often formulate and sell pelleted feeds as a complete ration, eliminating that task for the animal owner. Pelleted feed can be purchased for almost all animals, from rabbits to swine.

**USE OF BY-PRODUCTS IN FEED**

The use of crop and animal processing by-products in animal feed is an excellent example of increasing efficiency by eliminating waste. Instead of being placed in landfills, scraps and waste from processing plants are recycled into animal feed. **Rendering** means to reduce, convert, or melt down fats by heating. A rendering plant is a facility that takes waste animal products and processes them into fertilizers, fats for animal feeds, and so on.

**Crop By-Products**

Common protein supplements for animal feeds are soybean, cottonseed, linseed, and peanut meal. All of these feedstuffs are all by-products of the oil extraction process. Soybean meal is the most widely used in animal feeds. Some feeds, like corn gluten meal, are slightly acidic and will corrode metal containers if wet. Refrigeration or preservatives can lengthen the storage life of wet forms. Mixing hard-to-store wet products, such as ethanol waste, with dry, bulky feeds can also lengthen storage life. Distiller’s grains can be obtained and fed wet or dry. If the processing plant dries the distiller’s grains, energy and labor is required, making the product more expensive. If distiller’s grains can be picked up wet from the processing plant and fed within a short period of time, cost is reduced. However, the storing of wet distiller’s grains is a limiting factor, as they spoil relatively quickly.

**Animal By-Products**

While the use of some animal by-products in the rations of animals has sparked concern among some people and groups, these by-products have been approved by the FDA for use in animal feed. Animal by-products are widely used in animal feeds. However, bovine by-products should not be used in cattle rations because of the risk of spreading diseases, such as bovine spongiform encephalopathy (BSE), sometimes called mad cow disease. Examples of animal by-products used as protein supplements include meat scraps, meat and bone meal, fish meal, dried milk, blood meal, feather meal, and **tankage** (cooked, dried, and ground animal products).
tissues from slaughterhouses and rendering plants). Storage containers with these by-products should be kept tightly closed in a cool, well-ventilated area. These materials cannot be stored long-term, because the fat they contain will become rancid.

**Summary:**

It is important to feed animals well-balanced, palatable rations that are suited to their digestive systems. The two main types of feedstuffs are roughages, used primarily in ruminant rations, and concentrates, used in ruminate and nonruminant rations. Feed additives may also be used in the ration to improve performance or control disease and parasites. The way a feed is processed affects palatability and digestibility. Animal and plant by-products can be used alone as feedstuffs or mixed with other feeds to provide a balanced ration.

**Checking Your Knowledge:**

1. What is the difference between a roughage and concentrate?
2. This is a plant that can “fix” nitrogen from the air so that it can be used by the plant.
3. What is the most widely used energy feed?
4. These are compounds used to control various species of parasitic worms of animals.
5. What are two methods used to process feedstuffs?

**Expanding Your Knowledge:**

Obtain a tag from a feed bag and identify the different types of feedstuffs included in the ration. Which materials are present in highest quantities? Which are only present in minimal quantities? Which ingredients are considered supplements? Using this information, what animals are most likely to use this feed most efficiently?

**Web Links:**

- **Livestock Feed, Forage, and Nutrition**
  [http://edis.ifas.ufl.edu/TOPIC_Livestock_Feed_Forage_and_Nutrition](http://edis.ifas.ufl.edu/TOPIC_Livestock_Feed_Forage_and_Nutrition)

- **Vitamin and Mineral Supplements**
  [http://www.admani.com/AllianceBeef/MoorMansMintrateBlocks.htm](http://www.admani.com/AllianceBeef/MoorMansMintrateBlocks.htm)

- **Distiller’s Feeds**
  [http://journeytoforever.org/biofuel_library/ethanol_motherearth/meCh6.html](http://journeytoforever.org/biofuel_library/ethanol_motherearth/meCh6.html)

- **Agricultural Career Profiles**
  [http://www.mycaert.com/career-profiles](http://www.mycaert.com/career-profiles)