



Unit 8) Animals Eat Plants, Too!

That was Then and This is Now...

THEN

"May I go with you, Ma?" Laura asked.

"No," said Ma. "Now listen to me. Be careful of fire. Nobody but Mary is to touch the stove, no matter how long I am gone. Nobody is to go outdoors, or even open a door, till I come back." She hung the milk-pail on her arm, and reached through the whirling snow till she got hold of the clothes-line. She shut the back door behind her.

Laura ran to the darkened window, but she could not see Ma. She could see nothing but the whirling whiteness swishing against the glass. The wind screamed and howled and gibbered. There seemed to be voices in it. Ma would go step by step, holding tight to the clothes-line. She would come to the post and go on, blind in the hard snow whirling and scratching her cheeks...

Ma would clean all the stalls with the pitchfork. Forkful by forkful she threw the old bedding on the manure-pile. Then she took the hay they had left in their mangers and spread it to make them clean beds.

From the hay-pile she pitched fresh hay into manger after manger, till all four mangers were full. Sam and David and Spot and her calf munched the rustling good hay. They were not very thirsty, because Pa had watered them before he went to town.

With the old knife that Pa kept by the turnip pile Ma cut up turnips. She put some in each feed-box, and now the horses and cattle crunched crisp turnips. Ma looked at the hens' water-dish to make sure they had water. She scattered a little corn for them, and gave them a turnip to peck. Now she must be milking Spot."¹

Laura Ingalls Wilder

Now

"We woke yesterday to three inches of snow and temperatures in the teens in central Kansas, with more snow predicted for the rest of the day. This storm was not a surprise, it had been predicted for nearly a week, and we were ready. We had fed up cattle and bedded down the bulls with fresh straw, but with the coming of snow there was much to be done again.

Cattle are like kids, I guess. They need fed every day...some days I would just rather snuggle on the couch with a blanket, a book and a cup of hot tea, but that can't happen until the cattle (and kids) are taken care of. So early yesterday when I saw the snow, I turned on the TV news and crossed my fingers that school was canceled so that I would have help with chores!

By 8:00 a.m. I had kids fed a warm breakfast and ready to head outside to help me take care of the cattle. Being a cattle rancher is often romanticized...you see a work-worn, yet handsome cowboy in boots, hat and chaps riding a horse behind a cow herd into the sunset and think that cattle ranching is a beautiful experience! Well...one of my goals is to allow my kids to make their own life choices, and if they chose to ranch, they need to know the realities of it...and it is hard to measure up to that picture of ranching.

So while we dressed for cold weather with long johns, hooded sweatshirts, coveralls, gloves, scarves and hats, there was none of the romance of the sunset scene. We dressed for warmth and work!

Cattle are amazing creatures—they are born outside, live outside and can stay warm in frigid weather. They need food for energy to keep warm, and water, and they are very excited about a bit of straw for bedding! As my kids and I spread out a few big round bales of straw, the bulls butted the bales and jumped around like puppies in it, spreading it around the area! After a bit of play, one or two will pick a choice spot and lie down in the midst of the pile and the rest will soon join them.

Throughout the day, as we worked to provide food and water for all the cattle on our ranch, we checked to make sure all were healthy and handling the weather well. They all really looked great and needed very little extra attention. The rest of the week is to be cold. I will continue to make sure they all have enough food for energy to keep them warm and replenish their bedding as needed.

Ranching is not the easiest job, but it is the most rewarding that I've ever done!"²

Debbie Lyons-Blythe, December 9, 2009
from Life on a Kansas Cattle Ranch blog



Cattle in Winter

Credit: Jana L. Carlson

INTRODUCTION

KANSAS ANIMALS

- LIVESTOCK
- WILDLIFE
- PETS AND COMPANION ANIMALS

ANIMAL NUTRITION

- ANIMAL FEED
- LABELING
- ESSENTIAL NUTRIENTS
 - WATER
 - CARBOHYDRATES
 - FATS
 - PROTEINS
 - MINERALS
 - VITAMINS
- CHANGING NEEDS

LIVESTOCK FEED

- ROUGHAGES
- CONCENTRATES

KANSAS CROPS

- GRAINS
- OILSEEDS
- FORAGES

FOOD SAFETY

- PROTECTING THE FOOD SUPPLY
- FOOD SAFETY AT ALL LEVELS

FEEDING ANIMALS

ENDNOTES

REFERENCES

TEACHER'S RESOURCES

Photo Credit: Stephen Ausmus, USDA ARS

THE FOOD WEB

Producers – make their own food using energy from the sun.
Example: plants.

Consumers – cannot make their own food and must eat plants or animals to survive. Examples: humans and animals.

Decomposers – break down waste and dead materials into nutrients that can be used by producers. Examples: earthworms, bacteria, and fungi.

CONSUMER GROUPS

Herbivore – eats only plants. Examples: cows, sheep, horses, and rabbits.

Carnivore – eats only animal tissues (meat). Examples: dogs, cats, snakes, bullfrogs, and spiders.

Omnivore – eats both plants and meat. Examples: humans, fish, mice, and many birds.

There are 22 standard amino acids, which are the building blocks for muscles, nerves, and organ tissues. Eight of these are considered essential because the body cannot produce them, so they must be absorbed through food consumption. Plant proteins lack one or more of these essential amino acids, but animal proteins, like those found in meat and milk, are complete proteins.

Just like humans, animals also need to absorb essential amino acids through their diets. Kansas crops play an important role in providing these necessary nutrients to maintain animal health for a wide variety of animals.

AMINO ACIDS

Amino acids are organic compounds that combine to form proteins. The terms "essential" and "nonessential" refer to their importance in the food consumed by a person or animal as both types of amino acids are necessary for body functions.

Nonessential amino acids are produced through the body's normal biological processes.

Essential amino acids cannot be made by the body and must be supplied through food.

KANSAS ANIMALS

The agricultural lands of Kansas support an abundant and diverse animal population. Kansas crops provide high-quality feed ingredients designed to meet the specific nutritional needs of many different animals, including livestock and wildlife species as well as pets and companion animals.



Sheep

Credit: Ron Nichols, USDA NRCS

FOOD PRODUCTION FACT

One-fourth of the world's beef and nearly one-fifth of the world's grain, milk, and eggs are produced in the United States.³

Livestock – animals kept for production purposes like meat, milk, wool, and eggs. Examples: cattle, sheep, swine, goats, and poultry. Also includes working animals like horses.

LIVESTOCK

Kansas supports a large livestock population, using both native grasses and cultivated plants that provide an ample supply of feed. The leading livestock industry in Kansas is the beef industry. According to the Kansas Agricultural Statistics Service, there are 6.3 million beef cattle in the state, more than twice as many cattle as there are people! While Texas is the only state with more total cattle, Kansas ranks third among the states in the number of cattle commercially processed each year. Nearly 25 percent of all the cattle fed for meat production in the United States are fed in Kansas, and the Kansas beef industry contributes more than \$5 billion to the state's economy each year.⁴

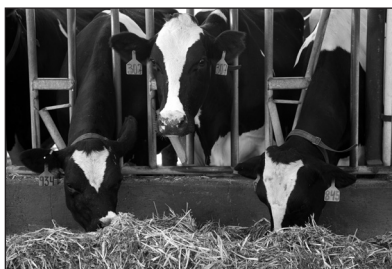
Although not nearly as large as the beef industry, the Kansas dairy industry also benefits from the feed ingredients provided by Kansas crop producers. High-quality alfalfa is one of the most important feed ingredients for dairy cattle, which require very specific nutrients from feed mixtures to optimize their milk production. Even though only one percent of the dairy cattle in the United States are found in Kansas, the Kansas dairy industry produces nearly 2.5 billion pounds of milk per year, valued at more than \$300 million according to the Kansas Agricultural Statistics Service.

**Kansas Beef**

Credit: Kansas Livestock Association

Kansas Dairy

Credit: USDA NRCS

**KANSAS DAIRY HIGHLIGHTS**

In Kansas, 22 dairies produce more than 65 percent of the state's milk supply.⁵

Only one percent of the dairy cattle in the United States are found in Kansas.

High-quality alfalfa is one of the most important feed ingredients for dairy cattle.

KANSAS BEEF HIGHLIGHTS

There are more than 6 million beef cattle in the state of Kansas.

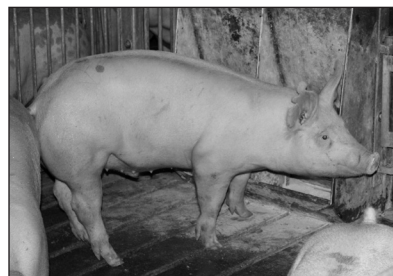
Texas is the only state with more cattle than Kansas.

Nearly 25 percent of all the cattle fed for meat production in the United States are fed in Kansas.

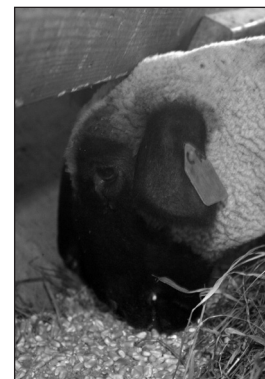
Western Kansas is home to several large dairies with more than 1,000 cows. In fact, 22 dairies in the state produce more than 65 percent of the state's milk supply.⁶ Many of those larger dairies relocated to Kansas from states like Arizona and California, drawn by the climate as well as the availability of quality feeds.

The swine and sheep industries also rely on Kansas crops for feed. Kansas farmers produce nearly 500 million pounds of pork each year.⁷ The Kansas swine industry consumes more than 30 million bushels of grain each year, according to the Kansas Pork Association. Grain sorghum is the primary feed ingredient, but corn and soybean products are also included in the swine diet.

In Kansas, the number of farms with swine and sheep are about the same, but the total number of swine found statewide (1.8 million) is much higher than the actual number of sheep on Kansas farms (70,000).⁸ The principal product of the Kansas sheep industry is lamb, meat from an animal that is less than one year old.

**Kansas Pigs**

Credit: Alex Lord, KFAC

**Kansas Sheep**

Credit: Alex Lord, KFAC

KANSAS SHEEP AND SWINE HIGHLIGHTS

There are about the same number of farms with swine and sheep in Kansas.

The total number of pigs and hogs found statewide is much higher than the actual number of sheep on Kansas farms.

A pig may be defined as a young swine weighing less than 120 pounds while a hog is a full-grown animal.

The meat produced by the swine industry is called pork. Kansas farmers produce nearly 500 million pounds of pork each year.⁹

The principal product of the Kansas sheep industry is lamb, meat from an animal that is less than one year old.

Animals Eat Plants, Too!

Other livestock industries having a positive impact on the Kansas economy include meat goats, poultry, and bison. The number of meat goats in Kansas continues to rise rapidly in response to an increase in demand for those meat products. The Kansas Agricultural Statistics Service reports that Kansas now ranks 13th among the states in the number of meat goats on farms. According to the Kansas Meat Goat Association, goat meat accounts for about 63 percent of the red meat consumed worldwide. Poultry industries, including those producing eggs, also provide local markets for crops and generate agriculture-related employment opportunities. In addition, small herds of bison roam Kansas grasslands and provide additional food products for consumers.

Horses and mules also consume large quantities of Kansas crops, especially alfalfa and hay. Although the number of horses in Kansas is not tracked, the American Horse Council estimates that there are 9.2 million horses in the United States, with the equine industry generating a national economic impact of \$39 billion each year.



Meat Goats

Credit: Beth Riffel



Chickens

Credit: Stephen Ausmus, USDA ARS



Horses

Credit: Tim McCabe, USDA



Mule (left) and Donkeys

Credit: Jana L. Carlson

KANSAS FACTS

In Kansas, more than 97 percent of the state's land is privately owned, according to the Kansas Department of Wildlife, Parks and Tourism.

Deer in Kansas feed mainly on agricultural crops like corn, alfalfa, grain sorghum, wheat, and soybeans.



Deer

Credit: Ken Hammond, USDA



Pheasant

Credit: Ron Nichols, USDA



Western Meadowlark

Credit: Gary Kramer, USDA NRCS



Turkey

Credit: Jeff Vanuga, USDA NRCS

WILDLIFE

In the United States, agricultural land provides habitat for 75 percent of the nation's wildlife.¹⁰ In Kansas, many wildlife species take advantage of the opportunity to feed on crops produced on Kansas farms and ranches. For example, deer in Kansas feed mainly on agricultural crops like corn, alfalfa, grain sorghum, wheat, and soybeans. Many wildlife species consume tender growing plant materials like green wheat or alfalfa, while other species feed mainly on the seeds produced by Kansas crops, such as grain sorghum, corn, or sunflowers. In addition to the year-round residents of the state, migratory birds like ducks and geese also feed on Kansas crops.

PETS AND COMPANION ANIMALS

Kansas crops have a significant impact on the diets of pets and companion animals by providing both meat and plant-based feed ingredients. According to the 2009-2010 National Pet Owners Survey, 62 percent of all U.S. households own a pet – more than 71.4 million homes! The most popular pets in the United States are (in order) cats, dogs, birds, reptiles, and horses. In the United States, more than \$18 billion is spent on pet food each year.¹¹ The U.S. Food and Drug Administration regulates pet food, pet treats, and pet snacks—just as the agency regulates other animal feeds.



Friends at Play

Credit: Mary Anne Stoskopf

Nutrient – a substance that is necessary for growth and development as well as the maintenance of the body's cells.

ANIMAL NUTRITION

People have nutritional needs and so do animals. Nutrients are substances that are necessary for growth and development, as well as the maintenance of the body's cells. They provide the energy and materials necessary for every vital process of a living organism.



Keeping Animals Healthy

Credit: Bob Nichols, USDA NRCS

ANIMAL FEED

Farmers and ranchers work closely with animal nutritionists, veterinarians, and other advisors to ensure that what they feed to their animals will keep them healthy. Pet food companies also employ veterinarians and nutritionists to formulate balanced diets, designed to provide the proper nutrition for optimum health and development.

Livestock producers often develop rations (feed mixtures) based on the cost of available feed ingredients because the margin of profit in animal and meat production industries is typically small. However, all producers balance feed costs with nutritional needs – only healthy, well-performing livestock allow the livestock producers to remain in business. Likewise, responsible pet owners make sure that the nutritional needs of their pets are met to keep them happy and healthy.

Veterinarian with Guinea Pig

Credit: Keith Weller, USDA ARS



RATION

Ration – an animal's diet, usually a mixture of feeds. Every ration is formulated differently depending on the animal's species, age, size, weight, and gender, as well as purpose of the animal (food production, work performance, or maintenance) and the environment.

A balanced ration is the amount of feed that will supply the proper nutrients in the correct proportions so that the animal can grow or function as desired.

HILL'S PET NUTRITION, INC.


Hill's Pet Nutrition, Inc. is headquartered in Topeka, Kansas. The company began in 1943 when veterinarian Mark Morris put Buddy, a guide dog for the blind, on a special diet to treat the dog's kidney problems. By reducing the levels of protein and minerals in Buddy's diet, Dr. Morris improved the dog's health considerably. Dr. Morris' partnership with the Hill Packing Company of Topeka, which provided canning equipment to Dr. Morris for Buddy's dog food, evolved into Hill's Pet Nutrition.

Today, Hill's® pet food products are available in 86 countries around the world. The company's products include therapeutic pet foods as well as pet foods formulated for specific stages of life and other special needs of healthy pets. Veterinarians and specialists at the Hill's Pet Nutrition Center in Topeka continue to develop new products to meet the needs of companion pets.

Source: Hill's Pet Nutrition, www.hillspet.com

LABELING

Packaged animal feed has nutrition labels very similar to the information labels found on human food products at the grocery store. These labels give feed information to help ensure an animal receives the proper nutrition, just as food product labels are intended to do for humans.

Brand Name	YOUR NAME FEEDS
Product Name	Beefy T Feedlot Finisher
Purpose Statement (Type of Animal)	 <p>For feedlot cattle</p>
Guaranteed Analysis (Nutrients)	<p>Guaranteed Analysis</p> <p>Crude Protein, minimum12% (This includes not more than 3.5% equivalent crude protein from non -protein nitrogen)</p> <p>Crude Fat, minimum2%</p> <p>Crude Fiber, maximum10%</p> <p>Calcium, minimum0.8%</p> <p>Calcium, maximum1.3%</p> <p>Phosphorus, minimum0.65%</p> <p>Salt, minimum11.0%</p> <p>Salt, maximum13.2%</p> <p>Potassium, minimum6.40%</p> <p>Vitamin A, minimum10,000 IU/LB</p>
Ingredient Statement	<p>Ingredient Statement</p> <p>Grain Products, Plant Protein Products, Processed Grain By-Products, Urea, Calcium, Lignin Sulfonate, Animal Fat, Vitamin A Supplement, D-Activated Animal Sterol (source of Vitamin D₃), Vitamin E Supplement, Folic Acid, Ethoxyquin (a preservative), Ground Limestone, Dicalcium Phosphate, Salt, Copper Sulfate, Manganous Oxide, Zinc Oxide, Ferrous Sulfate, Cobalt Carbonate, Calcium Iodate, Sodium Selenite.</p>
Use Directions	<p>FEEDING DIRECTIONS</p> <p>Feed as the complete grain ration.</p>
Responsible Party's Name and Address	YOUR NAME FEEDS City, State Zip
Quantity Statement	NET WT 50 LB (22.67 kg)

Source: Washington State Department of Agriculture

Animals Eat Plants, Too!

Nutrients listed on animal feed labels include five of the essential nutrients: carbohydrates, vitamins, minerals, fats, and proteins. Feed labels also list the type of animal the feed is intended for, ingredients, nutrition information, package size, and feeding instructions.

Type of Animal: A word or picture on the front of each label tells which animal the feed was developed for. It may also specify the stage of life or activity level most appropriate for that particular feed.

Ingredients: Animal feed is a mixture of products. Feed ingredients are listed from the most to the least amount present in the feed, i.e. the main ingredient is always listed first.

Nutrition: The label will list – as percentages of the dry weight of the product – the nutrients that the feed provides for the specified animal. This list must include the amounts of protein, fat, and fiber found in the feed.

Package size: The label states the amount of feed in the package. Animal feeds are almost always sold by weight.

Feeding instructions: Most labels will give instructions on how much to feed and how often to feed the animal.

ESSENTIAL NUTRIENTS

Essential nutrients are nutrients that the body cannot produce on its own. These nutrients must be digested and absorbed from other sources. The six essential nutrients vital to any animal's survival are carbohydrates, vitamins, minerals, fats, proteins, and water. Five of these essential nutrients can be found in the seeds or plant materials of the crops grown in Kansas. The sixth, water, covers around two-thirds of the earth's surface. Without its presence, humans, plants, and animals would all fail to thrive.

ESSENTIAL NUTRIENTS

Essential nutrient – a nutrient that the body cannot produce on its own.

There are six essential nutrients vital to any animal's survival: carbohydrates, vitamins, minerals, fats, proteins, and water.

Water

Water is the most critical component of any diet. It is a major part of all body fluids and performs several functions, including controlling body temperature, transporting nutrients, and carrying waste products. Water also helps digest feeds. Generally, animals are provided a sufficient amount of water, so they may consume as much water as they want at any time they choose. If water is limited for some reason, the amount of dry matter in the feed is reduced as the animals will not be able to properly digest the feed.



Water Tank

Credit: USDA NRCS

Carbohydrates

Carbohydrates usually make up the largest portion of an animal's food supply. Nearly 75 percent of all the dry matter in plants is carbohydrates – starch, sugar, cellulose, and other carbohydrates. Many molecules of glucose (sugar) make up starch, which is easily digested by animals. Cellulose must be converted to sugar, consuming energy in the process and making plant materials high in fiber (cellulose) less efficient sources of energy for animals. More easily digested forms of carbohydrates are generally stored in plant seeds, roots, and tubers.



Beef Cattle

Credit: Kansas Livestock Association

Carbohydrates are the most important source of energy in livestock rations and animal feeds because they are easily digested and readily available. Carbohydrates furnish energy for physical work, body functions, growth, and reproduction. Pregnant and lactating animals, those animals producing milk for their young, require additional carbohydrates. The young of all animal species require more easily digested feeds. Ruminant animals, such as cattle and sheep, utilize carbohydrates more easily than non-ruminants.

Fats

Fats supply a concentrated source of energy in an animal's diet, providing 2.25 times as much energy as an equal weight of carbohydrates. Fats also improve the flavor, texture, and palatability of feed. Found in every cell of an animal's body, fats provide insulation for the body, protection for vital organs, and energy reserves. Noticeable changes occur in the skin and hair of an animal when there is not enough fat in the animal's diet. Non-ruminants, such as swine and horses, can utilize a higher percentage of fats in their feed than ruminants.

FUNCTIONS OF ESSENTIAL NUTRIENTS

Water – controls body temperature, transports nutrients, and carries waste products.

Carbohydrates – furnish energy for physical work, body functions, growth, and reproduction.

Fats – improve flavor, texture, and palatability of feed as well as provide insulation for the body, protection for vital organs, and energy reserves.

Proteins – needed for growth and repair; form most of the muscles, internal organs, skin, hair, feathers, wool, hooves, and horns of animals.

Minerals – maintain animal health.

Vitamins – essential to the body's internal processes and critical to growth, development, and overall health.

RUMINANTS VS. NON-RUMINANTS

Ruminants – a group of animals that have a four-compartment stomach, which allows them to efficiently digest plants that humans cannot and absorb nutrients from forages like grasses. Examples of ruminants found in Kansas include cattle, sheep, goats, bison, deer, and antelope. Llamas and alpacas are "pseudo-ruminants" because they have only three compartments in their stomachs, rather than four.

Non-ruminants – animals that do not have a multi-compartmented stomach, like horses, swine, dogs, rabbits, mules, cats, and birds. Some non-ruminant animals, like horses, are able to consume and digest forages. Others, like swine, usually utilize different types of feed than ruminants.

Proteins

Protein is needed for the growth and repair of an animal's body. In animals, protein forms most of the muscles, internal organs, skin, hair, feathers, wool, hooves, and horns. Every day, a bit of protein in the body tissues breaks down. Protein not utilized for the repair of body tissues or other needs may be converted into body fat.

Proteins are composed of varying quantities of 22 amino acids. Essential amino acids, the amino acids that the body cannot produce by itself, must be provided in the animal's diet. However, each animal species digests and absorbs amino acids differently.

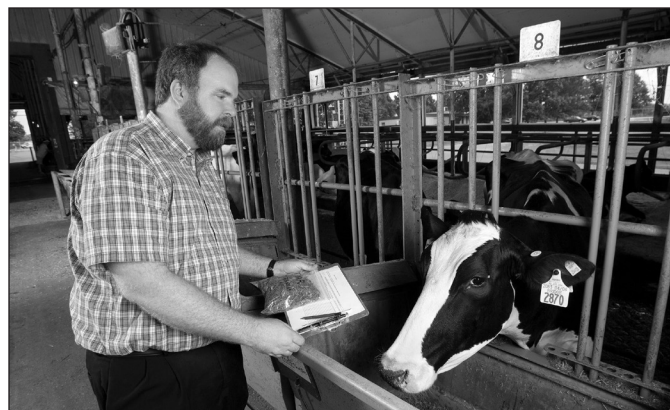
Minerals

Minerals are needed to maintain an animal's health. Mainly due to rapid bone growth, animals require more minerals while they are growing than as adults. Salt is an important mineral, necessary in most body functions as well as for stimulating an animal's appetite. Iron is critical to maintaining healthy blood and skin, while potassium, phosphorus, and calcium are necessary for growing and maintaining healthy bones. Other minerals are essential to maintaining animal health but in lesser amounts.

Vitamins

Like minerals, most vitamins are critical to animal growth, development, and overall health but in much smaller amounts than minerals. Vitamins are essential to the body's internal processes, including functions like metabolism (converting food into energy and other products needed to sustain life), respiration, and reproduction. Vitamins are obtained from sunlight, manufactured by the body itself, or easily obtained from plants or plant products in an animal's feed.

A supplement is a nutrient added to an animal's feed to improve the feed's quality. Healthy, fertile soil can pass its nutrients to the animal through the plants it grows. However, every geographic area gives its plant consumers a different mineral and vitamin profile; so it creates unique needs for even the same species of animal. Healthy animals with well-balanced diets do not need many vitamin or mineral supplements, but a small amount may be required. For example, green plants usually provide grazing animals with sufficient amounts of vitamins A and E, but when green plants are not available, such as in the winter months, it may be necessary to add those vitamins to an animal's diet.



Dairy Cattle

Credit: Peggy Greb, USDA ARS

CHANGING NEEDS

Nutritional needs change as an animal grows and reaches each new stage of life. It takes a variety of feed ingredients to make up the balanced rations and healthy diets during the different growth stages. By providing for the changes in nutritional requirements throughout its life cycle, any animal has the best chance for good health. The same type of care is necessary whether caring for a pet or producing livestock.



**Ewe and Her Lambs
(Quadruplets)**

Credit: Jana L. Carlson

NUTRIENTS FOR LIFE

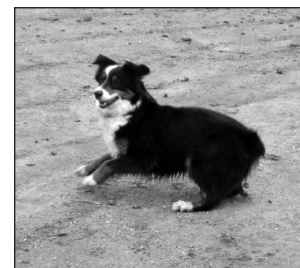
These examples from a dog's life illustrate how an animal's nutritional needs change during its life.

A newborn puppy's first nutritional needs are supplied through its mother's milk.

When the puppy is weaned, it needs a diet high in fat, protein, carbohydrates, and minerals to help it grow and develop. These nutrients will help it adjust to a diet of solid food, rather than liquid, and will supply the tools for musculoskeletal growth.

When the puppy grows into an adult dog, it needs less phosphorus, protein, sodium, and calcium. If the dog is a female and raises puppies of her own, her diet while pregnant and nursing must meet her nutritional needs as well as those of the developing puppies.

As the dog gets older and less active, the need for protein is reduced due to lower energy requirements and the need for fiber increases to prevent problems with constipation.



Working Dog

Credit: Mary Anne Stoskopf

LIVESTOCK FEED

Livestock feed is usually divided into two categories: roughages and concentrates. A healthy ration contains a balance of both.

ROUGHAGES

The two types of roughages (forages) are grasses – both native and cultivated – and legumes. These cellulose-based plants are high in fiber and are a good source of carbohydrates. In Kansas, grasses utilized as feed for animals include smooth brome grass, tall fescue, Eastern gamagrass, Bermuda grass, and bluestem. Crops grown for livestock feed include triticale and summer annual forages like sudangrass, forage sorghums, and sorghum-sudangrass hybrids. Legumes that are grown in Kansas for animal feed include alfalfa, clover, cowpeas, and hairy vetch.

Forages are a key element in the diet of ruminants. Cattle, as ruminants, are able to turn plants that are indigestible by humans into food that provides nutritional benefits when consumed. Forages, particularly grasses, are consumed by grazing animals, as well as harvested as hay.



Pasture, Russell County

Credit: Mary Anne Stoskopf



Forage Sorghum

Credit: Kim L. Fritzemeier



Grazing Cattle

Credit: Scott Bauer, USDA ARS



Grazing Sheep with Guard Llama

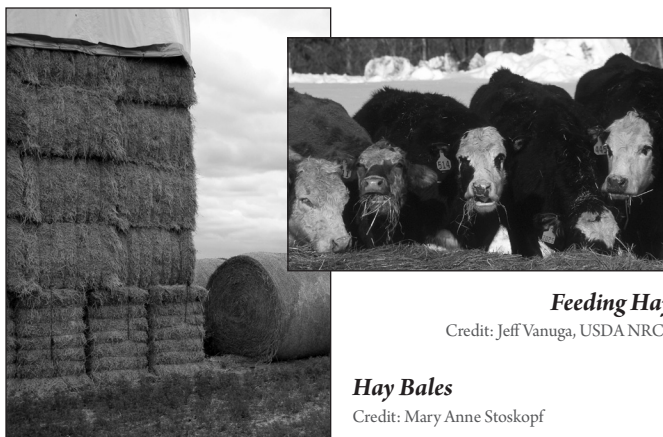
Credit: Jana L. Carlson

TYPES OF ROUGHAGE

Greenchop – high-moisture plant material chopped into small pieces in the field and immediately fed to livestock.

Hay – dried plant material collected and compacted into manageable units for transportation and feeding.

Silage – a sweet-tasting livestock feed made by chopping green plant material into fine pieces, packing the chopped plant material tightly together, and allowing it to ensile (ferment) while it is being stored and before it is fed to livestock.



Feeding Hay

Credit: Jeff Vanuga, USDA NRCS

Hay Bales

Credit: Mary Anne Stoskopf

When harvested as hay, forage crops are cut or swathed, dried in the summer sun, and baled into round or square bales. This allows the farmer or rancher some control over the amount of plant material eaten by livestock. However, the nutritive value of the hay depends on the timing of harvesting activities. Typically, as forage plants mature, the fiber content (cellulose and lignin) increases, which lowers the digestibility of the feed. Therefore, forage plants are generally harvested before they fully mature (begin to direct their energy towards producing seeds). Since the leaves contain the most nutrients, all dried plant materials are handled carefully so that the leaves remain attached to the stems as the bale of hay is formed.

When forages are harvested as green chop or silage, more of the nutritional value is preserved. Silage is the product that results after a green, immature crop has been harvested, stems and all, chopped into small pieces, then stored and fermented. Producers may choose to make silage if they have determined that a corn or grain sorghum crop will not have a good grain yield if it is harvested at full maturity. Thus, the crop can still be utilized. Corn silage, harvested before the corn kernels have fully matured and dried down, is an excellent source of carbohydrates for cattle.



Silage

Credit: Kim L. Fritzemeier



Silage Cutter

Credit: Kim L. Fritzemeier

Harvesting Silage

Credit: Kim L. Fritzemeier

CONCENTRATES

Concentrate – a mixture of seeds fed to animals; can be fed whole, ground, or rolled (flattened); also includes grain or forages compressed into pellets as well as coproducts from milling grain or processing grain or oilseeds.

Flour milling coproducts include bran – the outer layer of the kernel – and middlings, also known as "midds," which may include bits of bran and flour, as well as seeds removed during the cleaning process before the grain is milled into flour.

Meal is a coproduct of processing oilseeds into vegetable oil. The meal is what is left of the seed after the oil has been extracted.

Distillers grains are coproducts of the fermentation process that produces ethanol from grain. During fermentation, only the starch component of the seed or kernel is converted into alcohol and removed. Distillers grains are the remains of the seeds or kernels.



Animal Feed

Credit: Alex Lord, KFAC

CONCENTRATES

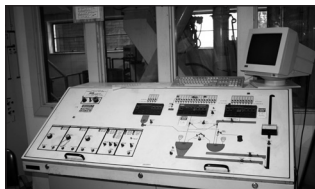
Concentrates are mixtures of seeds fed to animals. Concentrates are low in fiber and have nutrients that are easily digestible. Concentrates are often high in protein. Grains, such as wheat, corn, and grain sorghum, can be ground, rolled, or fed whole. Grinding grain in a feed mill produces a coarse mixture of all the pieces of the seed kernels. On the other hand, rolling the grain compresses the kernels into uniformly sized particles. Depending on the livestock species, reducing the particle size may improve the digestibility of the grain.



Concentrates also include grains and forages like alfalfa that are used in pelleted products, like dog and cat food, as well as livestock feed.

Ground Corn

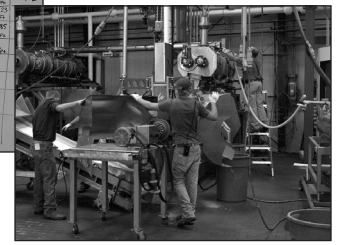
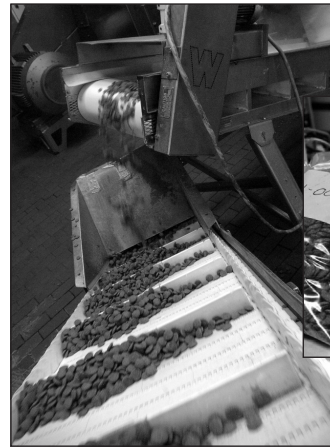
Credit: Alex Lord, KFAC



Feed Mill Controls

Credit: Alex Lord, KFAC

Run	Recipe	Temp	Size	Load	Temp	Dry	Temp
1	SALES 35% cold meat	45% 10	30	380	372	Density	19
2	SALES 35% cold meat	45% 10	29	380	372	Density	19
3	SALES 35% cold meat	45% 10	28	380	372	Density	19
4	SALES 35% cold meat	45% 10	26	380	372	Density	19
5	SALES 35% cold meat	45% 10	27	380	372	Density	19
6	TT 700	45% 10					
7	TT 700	45% 10					
8	TT 700	45% 10					
9	SALES 35% cold meat	45% 10	29	380	372	Density	19

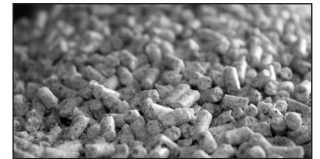


Manufacturing Dog Food

Credit: Wenger Manufacturing

The pellets are formed by breaking the kernels or plant materials down into very small pieces and then reforming the pieces into pellets using heat and compression.

The coproducts of processing or milling grain are also considered concentrates. Flour milling co-products include bran – the outer layer of the kernel – and middlings, also known as "midds." Midds are the remnants of the flour milling process and may include bits of bran and flour, as well as seeds removed during the cleaning process before the wheat is milled into flour.

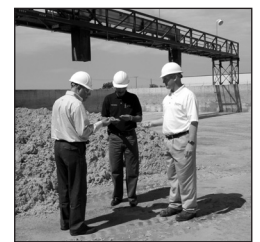


Feed Pellets

Credit: Alex Lord, KFAC

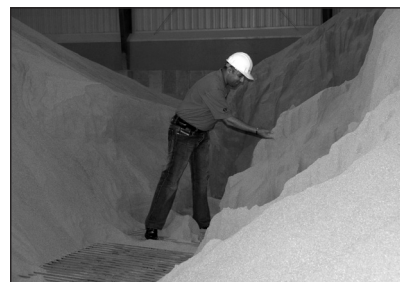
Meal, a coproduct of processing oilseeds into vegetable oil, is also a concentrate. The meal is what is left of the seed after the oil has been extracted. Hulls that are removed before the oilseeds are processed, such as those covering sunflower kernels and cottonseed, are considered roughages.

Distillers grains are another form of concentrates. As ethanol production has increased in recent years, the amount of distillers grains, an ethanol coproduct used as livestock feed, has also increased. During the fermentation process that produces ethanol from grain, only the starch component of the seed or kernel



Wet Distillers Grains

Credit: ICM, Inc.

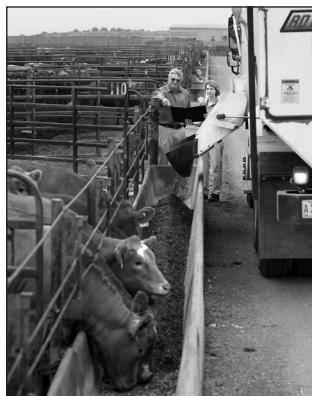


Dried Distillers Grains

Credit: ICM, Inc.

Animals Eat Plants, Too!

is converted into alcohol. Once the starch is removed, what remains of the seeds or kernels – called distillers grains – cannot produce any more ethanol and is available for livestock feeding. Because the starch has been removed, there are limits to how much distillers grains can replace other grains or coproducts in a livestock ration. Recommendations vary by species, ranging from 10 percent in poultry or swine rations to 40 percent in beef cattle rations.



Feed Ration

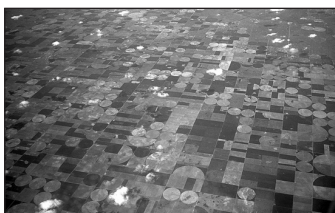
Credit: Stephen Ausmus, USDA ARS

A typical feed ration for beef cattle might include corn, soybean meal, brome hay, alfalfa, and vitamin and mineral supplements. Livestock producers must evaluate all feed and water sources for their animals to make sure the animals receive the appropriate amount of all the nutrients to ensure optimum growth and development.

KANSAS CROPS

Cropland is the leading use of land in Kansas, followed by pasture and rangeland, including both native grasslands and grass stands that have been reestablished on land that was once cultivated. These uses represent more than 90 percent of the state's land area.

In Kansas, the widespread availability of crops makes it economical to produce livestock in the state. Typically, feed costs account for 60 to 70 percent of livestock production costs. Over the years, livestock industries have been drawn to Kansas, taking advantage of opportunities to reduce the costs of transporting feed ingredients to the livestock as well as the ample supplies of feed produced in the state. Kansas crops used as livestock feed include grains, oilseeds, and forages.



**Finney County Cropland
(Aerial View)**

Credit: John Charlton, KGS

GRAINS

Corn is the grain most widely used in livestock feed. In fact, nearly 60 percent of the corn produced in the United States is fed to livestock in either the United States or other countries.¹² Shelled corn (corn kernels removed from the cob) is one of the highest energy feeds available. Shelled corn is fed as whole kernels or rolled, ground,

KANSAS CROPLAND

Cropland is the leading use of land in Kansas, followed by pasture and rangeland. These three uses represent more than 90 percent of the state's land area.

FEED COSTS

Typically, the cost of feed accounts for 60 to 70 percent of livestock production costs.

FEED FACTS

Corn is the grain most widely used in livestock feed. Nearly 60 percent of the corn produced in the United States is fed to livestock in either the United States or other countries.¹³

More than 80 percent of the grain sorghum produced in Kansas is fed to livestock.

Wheat is similar to corn in feed value, but it is not typically used in livestock rations because wheat usually has a higher market value as a food crop.

For every bushel (60 pounds) of soybeans that is crushed to extract oil, 80 percent (48 pounds) becomes soybean meal. Today, the U.S. poultry industry consumes more than 50 percent of all the soybean meal produced in this country.

Nearly all of the sunflower meal produced in the United States is consumed as a livestock feed ingredient. On average, one ton of cottonseed (processed into cotton oil) produces about 910 pounds of meal.

Alfalfa produces a greater amount of protein per acre than any other livestock feed, making it the most important forage crop grown in the United States. Most of the alfalfa produced in Kansas is fed to beef cattle.

or flaked. Cornmeal, a coproduct of the processing of corn for oil, and distillers grains, a coproduct of processing corn for ethanol production, provide slightly less energy than shelled corn. Cornmeal provides about 90 percent of the energy of shelled corn, while one pound of distillers grains can be substituted for approximately 1.25 pounds of corn in beef cattle rations.¹⁴ All species can utilize corn and corn coproducts, which are fed in combination with other feeds in order to get the maximum energy out of the corn without causing digestive problems. In addition, corn silage is a major feed ingredient used in Kansas.

Grain sorghum kernels are smaller than corn kernels but are generally rolled or ground when included in a feed ration to break down the seed coat and make the grain sorghum easier to digest. Since the feed value of grain sorghum is similar to that of corn, grain sorghum may replace up to 100 percent of the corn in a feed ration. Grain sorghum does have more protein and fat than corn but it is lower in carotene (vitamin A). Sorghum silage and distillers grains from grain sorghum



Corn Kernels

Credit: Stephen Ausmus, USDA ARS



Grain Sorghum Kernels

Credit: Kansas Grain Sorghum Producers Association

Feed value – an analysis of the main nutrients that make up each type of feed used in a ration; used to formulate rations that balance nutritional needs with the costs of the individual ration components.

USING GRAIN SORGHUM IN PET FOOD ¹⁵

Dog food and cat food require grain sorghum to be cooked and then placed in the pet food.

Bird seed is not processed and uses the whole grain sorghum kernel.

used to produce ethanol are also important feed products, although sorghum silage is generally lower in energy content than corn silage. More than 80 percent of the grain sorghum produced in Kansas is fed to livestock.

Wheat is also similar to corn in feed value, being high in both energy and protein. However, wheat usually has a higher market value as a food crop so it is not typically used in livestock rations. When it is fed to livestock, wheat is mixed in with other grains because wheat is rapidly digested, which may cause digestive problems. In Kansas, many livestock producers use the growing green wheat in the fall as a forage crop, allowing animals to graze the wheat plants before the plants enter dormancy.



Sheep Grazing Wheat Pasture

Credit: Jana L. Carlson

OILSEEDS

A high-protein residue called "meal" remains after oil is extracted from oilseeds. This coproduct is a valuable livestock feed, used as a protein supplement in livestock rations. Soybean meal, cornmeal, cottonseed meal, and sunflower meal are just a few of the plant-based protein supplements used in livestock rations.

For every bushel (60 pounds) of soybeans that is crushed to extract oil, 80 percent (48 pounds) becomes soybean meal. In the early 1950s, the availability of soybean meal as a low-cost, high-protein feed ingredient triggered an expansion in livestock and poultry production in the United States. Today, the U.S. poultry industry consumes more than 50 percent of all the soybean meal produced in this country. The swine industry also consumes large quantities of soybean meal. Swine cannot digest raw soybeans but can eat soybean meal because the soybeans were cooked during the oil extraction process.

Nearly all of the sunflower meal produced in the United States is consumed as a livestock feed ingredient. Oilseed sunflowers are also



Soybean Meal

Credit: Kansas Soybean Commission



Pigs

Credit: Regis Lefebure, USDA ARS

fed to dairy cattle, as well as "whole cottonseed." Cottonseed meal is a high-protein feed, often mixed with other feed ingredients, while cottonseed hulls are fed to livestock as roughage, rather than as a protein supplement. On average, one ton of cottonseed produces about 910 pounds of meal and 540 pounds of hulls.



Beef Cattle Grazing Pasture

Credit: Stephen Ausmus, USDA ARS

FORAGES

Forages include pastures and crop residues harvested by grazing animals, as well as forage crops harvested as greenchop, silage, or hay. In Kansas, pastureland and rangeland is the second leading use of the state's land, accounting for nearly 35 percent (18.242 million acres) of the state's total surface area.

Alfalfa produces a greater amount of protein per acre than any other livestock feed, making it the most important forage crop grown in the United States. In addition to protein, alfalfa provides other important nutrients like calcium and carotene. In Kansas, only the highest quality alfalfa (high in protein and low in fiber) is fed to dairy cows. Most of the alfalfa produced in Kansas is fed to beef cattle.

Alfalfa is also important in the diets of horses, sheep, and small animals like rabbits, mice, and gerbils. Many animals eat dehydrated alfalfa made by drying, grinding, and forming the alfalfa into cubes or pellets appropriately sized for the targeted animal species.



Dairy Cattle

Credit: USDA NRCS

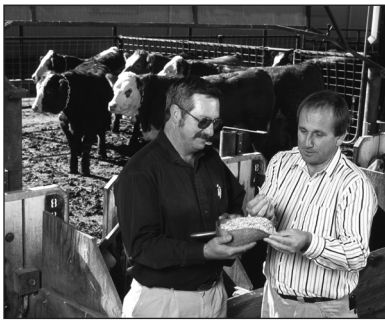


Beef Cattle

Credit: Kansas Livestock Association

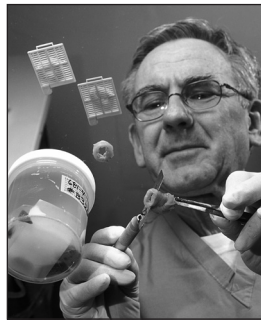
FOOD SAFETY

Agricultural producers provide high-quality feed ingredients to their livestock to provide the proper nutrition for growth and development, as well as to maintain the health of the animals. Close attention is paid to the health of every animal produced for food, from the farm to the processing plant.



Feeding Healthy Cattle

Credit: Scott Bauer, USDA ARS



Food Safety Testing

Credit: Stephen Ausmus, USDA ARS

PROTECTING THE FOOD SUPPLY

The book "The Jungle" by Upton Sinclair was published in 1906. This was a fictionalized story about a family that included fictional scenarios about conditions in the meat packing industry in Chicago. The book's descriptions of disgusting conditions and the sale of rotten meat to unsuspecting customers caused an uproar with the American public. However, the need for standardized meat inspection became apparent after government representatives went on surprise visits to the meat packing houses. Responding to both the public uproar and the conditions found during the surprise inspections, President Theodore Roosevelt signed the Federal Meat Inspection Act of 1906, which required the U. S. Department of Agriculture (USDA) to inspect all animals at the time they were processed for human consumption. Additional laws and regulations have been passed since that first law, including the 1967 Wholesome Meat Act, all of which are designed to protect the food supply.



Truckload of Beef, 1923

Source: Library of Congress

Today, more than 6,500 inspectors from the U.S. Department of Agriculture's Food Safety and Inspection Service (FSIS) are in the processing plants every day, working to ensure the continuing safety of the food supply.¹⁶ Currently, state and federal meat inspectors must identify meat as healthy, sound, wholesome, and properly labeled before it is sold or consumed by the public. The facilities where animals are processed must be uniformly sanitary; the specifications that must be met cover the water supply and drainage, waste disposal,

USDA FOOD SAFETY AND INSPECTION SERVICE FACTS

Inspections are mandatory and paid for out of tax dollars.

Inspections cover all raw meat and poultry sold in interstate and foreign commerce, including imported products.

The agency monitors meat and poultry products after they leave federally inspected plants.

The agency monitors state inspection programs, which inspect meat and poultry products sold only within the state in which they are produced.

INSPECTION VS. GRADING

Inspection – mandatory; paid for out of tax dollars; inspects meat and poultry products for wholesomeness (health), including both live animals and carcasses.



USDA Meat Inspection Stamp

Note: the number "38" is an example of the number that identifies the official establishment where the product is prepared.

Source: USDA Food Safety and Inspection Service

Grading – voluntary; paid for by meat and poultry producers or processors; assesses a grade level on quality characteristics, based on nationally uniform federal standards.



USDA Meat Grade Stamp

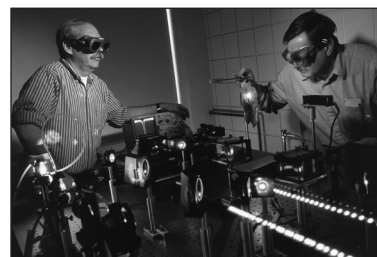
Source: USDA Agricultural Marketing Service

lighting, ventilation, and refrigeration. Workers at the processing facilities are under surveillance for their compliance with the government's standards and regulations, and inspectors always have reinspection privileges.

Inspectors also label any prepared meat item with the following items: name of the product, the ingredients, the quantity, an inspection legend or seal, and the processing firm's name and address.

The same standards apply to meat that is imported into the United States. USDA Food Safety and Inspection Service inspectors are responsible for assuring that all imported meat, poultry, eggs, and egg products are safe, wholesome, unadulterated, and properly labeled and packaged, just as they do for domestically produced foods.

In addition, the U.S. Department of Agriculture works with food microbiologists to develop new strategies and techniques to monitor safe food production. In the United States, if any food is found to be contaminated for any reason, all monitoring efforts and plant inspections are intensified. Authorities and scientists work together to find out when, where, and why a contamination occurred. If necessary, there will be a product recall.



Laser Scanning Research

Credit: Keith Weller, USDA ARS



Testing Eggs

Credit: Stephen Ausmus, USDA ARS

State, county, and local health departments also conduct inspections anywhere food products are sold or prepared, including grocery stores, school and hospital kitchens, restaurants, bakeries, and convenience stores. Federal, state, and local officials also investigate any incidents where food contamination might occur, such as an accident involving a semi-truck transporting meat, a restaurant that has experienced a fire, or a grocery store damaged by a tornado. If officials determine that contamination has been possible, all food products and ingredients must be destroyed.

FOOD SAFETY AT ALL LEVELS

Food safety is a serious responsibility for everyone involved in the production, processing, preparation, and consumption of food products. Farmers and ranchers realize it is in their best interests to ensure that the food supply is as safe as possible. They are proactive and work to prevent the need for a product recall, rather than reacting to a pathogen outbreak. In 1985, the beef industry voted to put in place a check-off system based on live cattle sales. The Cattlemen's Beef Promotion and Research Board administers the check-off program and determines where the money should be spent, subject to USDA approval. According to Duane Theuninck, past chair of a joint industry beef safety committee, cattlemen cannot afford to compromise the safety of their product. Theuninck added, "Checkoff-funded safety research is an important way for us to maintain and enhance beef safety and ensure consumer confidence."¹⁷

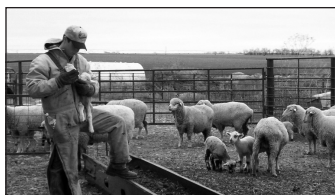
Livestock producers also know that healthy animals result in a higher-quality food supply for consumers. The livestock industry has compiled a set of best management practices that outline appropriate animal production techniques from the farm to the processing plant.

Food safety is important at all levels because any raw agricultural product can become contaminated. Despite aggressive sanitation and prevention efforts during handling, processing, and transporting, food may still become contaminated during preparation, cooking, serving, or storage. Food consumers must help protect themselves by always following proper food safety practices.



Breakfast Beef Burritos

Credit: The Beef Checkoff



Raising Healthy Lambs

Credit: Jana L. Carlson



Milking Parlor

Credit: Keith Weller, USDA ARS

FOOD SAFETY BASICS

Keep hands, cooking utensils, and surfaces that come into contact with food **clean**.

Separate raw meat and poultry and their juices from other foods that are being prepared or are ready to eat.

Cook foods to the proper internal temperatures.

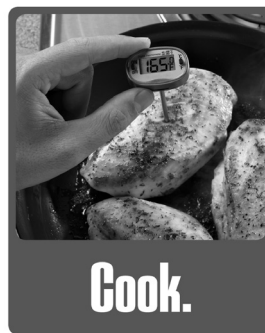
Chill and refrigerate foods promptly at a temperature of 40 degrees Fahrenheit.



Clean.



Separate.



Cook.



Chill.

Source: USDA FSIS

Limiting foodborne bacteria should be the number one priority for food consumers. The principles of food safety are universal; they apply to all foods, including meat. The basic principles are: keeping hands, cooking utensils, and surfaces that come into contact with food clean; separating raw meat and poultry and their juices from other foods that are being prepared or are ready to eat; cooking foods to the proper internal temperatures; and refrigerating foods promptly at a temperature of 40 degrees Fahrenheit.

FEEDING ANIMALS

The health, growth, and development of each animal depends on the food it eats. If the animal's diet contains the appropriate nutrients, the animal will grow and develop properly, maintain its weight when appropriate, and have the energy necessary for an active healthy life. Kansas crops supply the feed ingredients that provide necessary nutrients for a variety of animal species, ranging from wildlife to livestock to pets and companion animals. ■



Dairy Cow

Credit: Keith Weller, USDA ARS

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TEACHER'S RESOURCES

The Kansas Foundation for Agriculture in the Classroom (KFAC) offers lesson plans and other educational resources on the KFAC website: www.ksagclassroom.org.

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