

Animal Feed: See, Touch, and Do

A Hands-On Lesson Plan on the Basics of Animal Feed and Animal Nutrition

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Topic:

Exploring animal nutrition and the relationships between feed ingredients in livestock diets

Content (Key Words):

Animal feed, livestock diets, animal nutrition, feed mixing, particle size

Goals:

1. To describe the role of an animal nutritionist.
2. To discuss why it's important to feed animals a balanced and nutritious diet.
3. To discuss and describe the feed milling process.
 - a. Do all feed ingredients need to be processed?
 - b. What are the ideal size and shape of feed ingredients in livestock diets?

Objectives (Learning Outcomes of Lessons and Activities):

1. To recognize animal nutritionist as a possible career path for an individual interested in animals.
2. To describe the importance of animal feed processing and mixing.
3. To explain feed/ingredient sorting and the effects of particle size and shape on feed mixing.

Preparation:

The basics of animal nutrition are easily explained and explored with actual examples.

1. Items needed to complete activities (make sure to have enough supplies for all students to participate either in small groups or as individuals):
 - Cereal (several kinds, but a minimum of three)
 - Fine sand, rocks, and marbles
 - Containers with lids that hold more than 4 cups (one per group)
 - Plastic cups (two per group)
 - Plastic sandwich bags
2. Consider asking students to bring an assortment of animal feed, such as samples they may have at home (cat, dog, horse, bird, or rabbit food). All of these create wonderful starting points for discussions about animal feed and feed manufacturing.
3. Additional items nice to have on hand for the activities:
 - Whole corn kernels
 - Ground corn (several sizes if possible)*
 - Whole soybeans
 - Soybean meal*
 - Salt

*You can usually get ground corn and soybean meal from a local feed mill or feed store. Agricultural universities and your local Cooperative Extension office are also good places to ask.

Lesson 1:

This lesson explores what an animal nutritionist does, and career paths related to animal nutrition.

An animal nutritionist is an individual who has a passion for animals and is an expert on animal feed and how the feed is used by animals. An animal nutritionist normally has specialized training on how to make the best diet for either a specific species (cats, dogs, pigs, chickens, cows, or horses) or group of animals (ruminants or monogastric animals). Ruminants, such as cows, sheep, and goats, have a complex four-chambered stomach. Monogastric animals, such as dogs, chickens, and pigs, have a simple single-chambered stomach (people have monogastric stomachs, too). The job of an animal nutritionist is to make sure the diet is balanced and meets the nutritional requirements of the specific animal species or animal group.

Many animal nutritionists work with or in feed mills. The relationship between the nutritionists and the feed mill operators and managers is very important. Communication between these individuals is essential to make sure appropriate ingredients are selected and correctly processed to meet the animals' nutritional needs.

There are many career paths related to animal nutrition. Education requirements vary depending on the position. A bachelor's degree in animal science or a related field is usually required. Some positions require a master's degree or doctorate in animal nutrition or a related field.

Careers related to animal nutrition include:

- Animal nutritionist, formulating diets for pets, livestock, zoo animals and exotic pets, or fish
- Laboratory personnel, making sure the feed ingredients and finished feed are properly manufactured
- Feed mill operator/manager
- Nutrition salesperson, selling everything from specific feed ingredients to finished feed
- Animal nutrition consultant, as a private consultant or for a large feed company
- Researcher in animal nutrition or animal science
- Teacher (agriculture, animal nutrition, or animal science)
- A career at a drug company, in either sales or research*
- A career in a regulatory agency, such as the Food and Drug Administration (FDA)**

*Some drugs for livestock are given in the animals' feed, in what's called "medicated feed." Drug companies often employ animal nutritionists to research new drugs for making medicated feed, figure out the best way to mix a new drug into animal feed, and design methods to test the quality of new medicated feed products.

**Regulatory agencies, such as FDA, also often employ animal nutritionists. FDA is responsible for making sure animal feed, including livestock feed, pet food, and pet treats, is:

- Pure and wholesome;
- Produced under clean conditions;
- Free of harmful substances; and
- Labeled appropriately and truthfully.

For medicated feed for livestock, FDA is responsible for ensuring that the drug added to the feed is safe and effective for the animals. FDA also makes sure it's safe for people to eat food products (such as milk, meat, and eggs) made from animals that ate the medicated feed.

Animal nutritionists working at FDA evaluate animal feed and medicated feed so the agency makes the best regulatory and scientific decisions about these products.¹

¹ FDA References on Animal Feed and Medicated Feed:

- [FDA's Role in Animal Health – Yes! No! Maybe So! – What FDA Does and Does Not Regulate](#), *FDA Veterinarian Newsletter*, Issue 3, 2010
- [Animal Food & Feeds](#)
- [Animal Feed Regulations](#)

Lesson 2:

This lesson explores the basic principles of preparing feed for pigs and chickens, although the concepts can be applied to many animals and expanded to include discussions around other animals and/or feed manufacturing topics. Both pigs and chickens are monogastric species and consume similar diets. The basic ingredients in pig and chicken diets are corn and soybeans (soybean meal). These ingredients are processed and manufactured to be similar in size (although not perfect).

Do you eat like a PIG?

Using “pig” as the example is always good because “to eat like a pig” has a negative meaning to most students. Many will answer NO!

However, YES is the correct answer in this case. Explain that if they really eat like a pig, then they are eating a very healthy and balanced diet, which contains all the nutrients their bodies need in the most appropriate amounts to promote energy, growth, and health. Pigs eat diets that are rich in whole grains, vitamins, and minerals. The diets are also balanced for protein and energy. Diets prepared for the pigs by the swine nutritionist are perfect – the pigs will eat everything their bodies need every time they consume a meal.

Why don't we just feed pigs and chickens whole corn?

Pigs and chickens can eat whole corn, but there are several reasons why whole corn should be processed (ground) before being fed to them:

- The nutrition within the corn kernel is better utilized (digested) by the animal if the kernel is ground.
- When whole ingredients are fed, pigs and chickens will pick out the ingredients they like best and eat those first (much like people picking out the M&Ms or chocolate chips in trail mix). Chickens have color preferences and will sort out the yellow whole corn to eat first. Pigs also sort out their favorite ingredients. Mixing appropriately-sized ground corn into the feed prevents this “feed sorting” and ensures that the pigs and chickens eat the correct amount of all ingredients in their feed.
- Ground corn helps produce high quality pellets. Whole corn or even course grinding of the corn does not produce high quality pelleted feed.



Activity 1: Particle Size

- Have the students break into groups of 3 or 4. Have several cereal varieties available. One way to get cereal variety is to ask each student to bring 1 cup of cereal from home. Make sure each student in the group has a different kind of cereal.



- Give the students a container to be the mixer. The container needs to have a lid and be able to hold more than 4 cups of cereal. Large yogurt containers with lids and jars with lids work well.
- Have each student in the group add 1 cup of cereal to the mixing container, for a total of 3 to 4 cups. Have one student act as the mixer by physically picking up and shaking the container for about 15 seconds.



- Once the cereals are mixed, have the students sort the cereals back into the original separate cereals, emphasizing that this is what animals do if allowed to pick and choose what they want to eat. The cereals are fairly easy to sort.



- Have the students take the same cereal and smash it into fine particles (easily done in a plastic sandwich bag with a fist or book). Once the cereal is smashed, have the students mix the cereals together again.



- Ask the students to again sort the cereals back into the original separate cereals. This sorting process is increasingly difficult when the cereals are of similar size. There still may be a few large pieces that the students can pick out, but overall, the cereals mix better and are more difficult to sort.



1. Do you need to grind all feed ingredients?

No, not all ingredients need to be ground. Some are available in appropriate sizes that can be mixed into feed as is. Salt is a good example. There are several sizes of livestock grade salts but use table salt as the example. Most students will recognize that salt is already small. Compare corn and salt (or any variety of ingredients) to emphasize the size difference.

2. What size should ingredients be ground to?

Particle size varies some across the animal nutrition industry, but ideally, all ingredients in pig and chicken feed should be similar in size to get the best mixture. Ingredients in pig and chicken feed are normally ground to about 700 microns. For comparison, 400 microns is very small (about the size of a piece of sand), 1200 microns is relatively large (about the size of the eye of a needle), and 700 microns is in the middle. Animal nutritionists and feed mill operators chose 700 microns based on the amount of energy (money) it costs to grind the ingredients and the best particle size for each ingredient, so it is best utilized by the animal. It is a balance between cost and animal performance (utilization).

3. What are some common problems related to particle size and other properties of the feed ingredients?

Animal nutritionists commonly deal with feed handling problems when formulating livestock diets:

Feed Handling Problems	
Typical Causes	Feed ingredients are ground too fine (small). Fat or another liquid product is added to the feed.
What Happens	When the ingredients are very small, the feed tends to pack together and has a hard time moving through the feeding system. Added fat, which increases the moisture content, causes the feed to pack together. The packed feed has a hard time moving through the feeding system.
End Result	Possible “out of feed” occurrence.
Example	Think of an hourglass minute timer filled with sand that comes with some board games. When the timer is turned upside down, the sand runs from the top to the bottom of the hourglass in 1 minute. Sometimes, the sand packs together and gets stuck. The timer has to be shaken to restart the flow. When feed packs together, it stops flowing through the feeding system. The feed lines or feeders may need to be agitated to restart the flow.

Because a growing and developing livestock animal should have constant access to feed, the animal nutrition industry wants to prevent all “out of feed” occurrences. Animal nutritionists work hard to formulate diets that won’t pack together and result in feed handling problems.

4. How is the feed ground?

The animal nutrition industry uses either a hammermill or a roller mill to grind the feed ingredients. Depending on time and student level of interest, you can include information on the process of grinding and how the two methods affect particle size and shape. Roller mill grinding of corn produces particles that are more uniform and rounder in shape compared to corn ground with a hammermill. As an example, compare the irregular shape of rocks (hammermill) to the more uniform, round shape of marbles (roller mill) in Activity 2.

Activity 2: Particle Size and Shape

- Have the students break into groups of 3 or 4. Provide each group with two plastic cups and enough fine sand and rocks (or marbles) to fill the cups. It doesn't matter if you use sand and rocks or sand and marbles, as both combinations show that smaller sized ingredients (sand) are more likely to pack together, creating a feed handling problem.



- Have each group build a cup-shaped castle with the dry (as is) sand and another castle with the rocks or marbles. Discuss how the sandcastle holds shape better than the rock or marble castle.



- If the groups want to explore the effect of particle shape, have them make castles with rocks and also with marbles. The rocks and marbles should be similar in size. The rocks stack together better than the marbles, due to the irregularity in their shapes (not all rocks are the same shape). Because of the uniformly round shape of the marbles, they don't pack together. Instead, they roll off each other.



The same principle applies to animal feed. The more uniform and round the ingredients, the less likely the feed will pack together. This decreases the chance of feed handling problems.

When making a feed that is fine (small) in particle size, it's better for the feed to have a more uniform, round shape. The tendency of the small particles to pack together (like sand) is offset by their uniform, round shape which causes the particles to not pack together and roll off each other (like marbles). This balance between size and shape reduces feed handling problems.

- Have the students add a small amount of water to the cup of sand and the cup of rocks or marbles and then make castles again. The water makes the sandcastle hold together even better, while the rocks or marbles still roll off each other. The sand with water is a perfect example of what really fine grinding and added fat (moisture) will do in feed lines and feeders.



With their expert knowledge of particle size and shape and other properties of the feed ingredients, animal nutritionists formulate livestock diets that:

- Maximize animal health and performance;
- Prevent feed sorting; and
- Prevent feed handling problems.